This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at http://books.google.com/

614.06
S227

STANFORD UNIVERSITY LIBRARIES


THE SANITARY INSTITUTE, INCORPORATED 1888.
SALUS GENERIS HUMANI.

1898.

[redacted]

JOURNAL

OF

THE SANITARY INSTITUTE.

(Being Volume XIX. of the Transactions of the Institute.)

1898.

LONDON:

OFFICES OF THE SANITARY INSTITUTE, MARGARET STREET, W.
EDWARD STANFORD, 26 & 27, COCKSPUR STREET,
CHARING CROSS, S.W.

1899

EDITING COMMITTEE.

MAJOR LAMOROCK FLOWER, *Chairman.*

BUSHELL ANNINGSON, M.A., M.D.

W. COLLINGRIDGE, M.A., M.D.

PROF. A. BOSTOCK HILL, M.D., D.P.H.

H. R. KENWOOD, M.B., L.R.C.P., D.P.H.

HENRY LAW, M.INST.C.E.

E. G. MAWBEY, M.INST.C.E.

J. F. J. SYKES, D.SC.

DAWSON WILLIAMS, M.D.

E. WHITE WALLIS, F.S.S., *Sub-Editor.*

LIBRARY
LELAND STANFORD JUNIOR
UNIVERSITY

The Institute is not responsible for the facts and opinions advanced in the Addresses, Papers, and Articles published in the Journal.

JCCN/S.'83-P.D.

130398

KENNY & CO., PRINTERS, 25, CAMDEN ROAD, LONDON, N.W.

TABLE OF CONTENTS.

CONGRESS AT BIRMINGHAM.

Section I.—Sanitary Science and Preventive Medicine.

Section II.—Engineering and Architecture.

Section III.—Physics, Chemistry, and Biology.

REVIEWS OF BOOKS.

OBITUARY.

[redacted]

LIST OF PLATES.

OFFICERS OF THE INSTITUTE FOR 1898–99.

Patroness.

H.R.H. THE DUCHESS OF ALBANY.

President.

H.R.H. THE DUKE OF CAMBRIDGE, K.G.

Past Presidents.

HIS GRACE THE DUKE OF NORTHUMBERLAND, K.G., D.C.L., LL.D.
HIS GRACE THE DUKE OF WESTMINSTER, K.G.

Vice-Presidents.

HIS GRACE THE ARCHBISHOP OF CANTERBURY, P.C.
RIGHT HON. EARL FORTESCUE.
SIR F. ABEL, BART., K.C.B., D.SC., D.C.L., F.R.S.
SIR HENRY W. ACLAND, BART., K.C.B., M.D., D.C.L., LL.D., F.R.S.
SIR DOUGLAS GALTON, K.C.B., D.C.L., LL.D., F.R.S. *(Treasurer.)*
SIR W. GUYER HUNTER, K.C.M.G., Q.H.S., M.D., LL.D., F.R.C.P.
SIR FRANCIS SHARP POWELL, BART., M.P.
SIR ROBERT RAWLINSON, K.C.B., M.INST.C.E. (deceased.)
SIR HENRY THOMPSON, F.R.C.S., M.B.LOND.
PROF. W. H. CORFIELD, M.A., M.D.OXON., F.R.C.P.
THOMAS SALT, M.A., D.L., J.P.
A. WATERHOUSE, R.A., F.R.I.B.A.

Registrar.

SIR W. GUYER HUNTER, K.C.M.G., Q.H.S., M.D., LL.D., F.R.C.P.

Council.

SIR DOUGLAS GALTON, K.C.B., D.C.L., LL.D. F.R.S., *Chairman.*

PROF. HENRY ADAMS, M.INST.C.E.
LEWIS ANGELL, M.INST.C.E., F.R.I.B.A.
BUSHELL ANNINGSON, M.A., M.D.
H. E. ARMSTRONG, D.HY., M.R.C.S.
A. WYNTER BLYTH, BARRISTER-AT-LAW.
H. PERCY BOULNOIS, M.INST.C.E.
W. COLLINGRIDGE, M.A., M.D., D.P.H.
H. H. COLLINS, F.R.I.B.A.
THOMAS W. CUTLER, F.R.I.B.A.
ROGERS FIELD, B.A., M.INST.C.E.
MAJOR LAMOROCK FLOWER.
EDWIN T. HALL, F.R.I.B.A.
PROF. A. BOSTOCK HILL, M.D. D.P.H.
LIEUT.-COL. A. S. JONES, V.C., ASSOC. M.INST.C.E.
H. R. KENWOOD, M.B., L.R.C.P., D.P.H.
BALDWIN LATHAM, M.INST.C.E., F.G.S., F.S.S.
HENRY LAW, M.INST.C.E.
CHARLES MASON, ASSOC.M.INST.C.E., A.R.I.B.A.
E. G. MAWBEY, M.INST.C.E.
R. E. MIDDLETON, M.INST.C.E.
ARTHUR NEWSHOLME, M.D., M.R.C.S., L.S.A., D.P.H.
PROF. J. LANE NOTTER, M.A., M.D.
LOUIS C. PARKES, M.D., D.P.H.
J. WALLACE PEGGS, ASSOC.M.INST.C.E.
G. V. POORE, M.D.
G. REID, M.D., D.P.H.
PROF. H. ROBINSON, M.INST.C.E.
J. OSBORNE SMITH, F.R.I.B.A.
J. F. J. SYKES, M.D., D.SC.
W. C. TYNDALE, M.INST.C.E.
DAWSON WILLIAMS, M.D., F.R.C.P.

Auditors.

W. COLLINGRIDGE, M.A., M.D. | ALFRED LASS, WOOD & CO.

Hon. Solicitor.

BASIL FIELD, B.A.

Secretary.

E. WHITE WALLIS, F.S.S.

Bankers.

THE UNION BANK, REGENT ST. BRANCH.

OFFICES—PARKES MUSEUM, MARGARET STREET, LONDON, W.

[redacted]

Congresses held by the Institute.

LEAMINGTON, 1877.

President.—B. W. RICHARDSON, M.D., LL.D., F.R.S.

Presidents of Sections.

Section I.—Edwin Chadwick, C.B.

" II.—George Wilson, M.A., M.D., F.C.S.

" III.—R. Brudenell Carter, F.R.C.S.

Honorary Local Secretaries—James Thompson, M.D., and Joseph S. Baly, M.R.C.S., F.L.S.

STAFFORD, 1878.

President.—EDWIN CHADWICK, C.B.

Presidents of Sections.

Section I.—B. W. Richardson, M.D., LL.D., F.R.S.

" II.—Henry Day, M.D., F.R.C.S.

Honorary Local Secretaries—William Ellis Clendinnen and H. B. Livingston.

CROYDON, 1879.

President.—B. W. RICHARDSON, M.D., LL.D., F.R.S.

Presidents of Sections.

Section I.—Alfred Carpenter, M.D., M.R.C.P.Lond., C.S.S.Camb.

" II.—Captain Douglas Galton, R.E., C.B., D.C.L., F.R.S.

" III.—G. J. Symons, F.R.S.

Honorary Local Secretaries—H. J. Strong, M.D., and Robert Hall.

EXETER, 1880.

President.—THE RIGHT HON. EARL FORTESCUE.

Presidents of Sections.

Section I.—Prof. de Chaumont, M.D., F.R.S.

" II.—R. Rawlinson, M.Inst.C.E., C.B.

" III.—Sir Antonio Brady.

Honorary Local Secretaries—H. Percy Boulnois, M.Inst.C.E., and E. J. Domville, M.R.C.S.E.

NEWCASTLE-UPON-TYNE, 1882.

President.—CAPT. DOUGLAS GALTON, R.E., C.B., D.C.L., F.R.S.

Presidents of Sections.

Section I.—Dennis Embleton, M.D., F.R.C.S.

" II.—H. Law, M.Inst.C.E.

" III.—Arthur Mitchell, M.A., M.D., LL.D., F.R.S.

Honorary Local Secretaries—H. E. Armstrong and J. H. Amos.

GLASGOW, 1883.

President. PROF. G. M. HUMPHRY, M.D., F.R.S.

Presidents of Sections.

Section I.—Prof. W. T. Gairdner, M.D., LL.D.
„ II.—Prof. T. Roger Smith. F.R.I.B.A.
„ III.—R. Angus Smith, Ph.D., F.C.S.

Honorary Local Secretaries—J. B. Russell, M.D., James Sellars, and Henry Johnston.

DUBLIN, 1884.

President.—SIR ROBERT RAWLINSON, C.B.

Presidents of Sections.

Section I.—T. W. Grimshaw, M.A., M.D.
„ II.—C. P. Cotton, M.Inst.C.E.
„ III.—Charles A. Cameron, F.R.C.S.I.

Honorary Local Secretaries—John Beveridge, Charles A. Cameron, M.D., J. J. Diggles La Touche, M.A., Thomas A. Drew, Q.H.A., and William R. Maguire, F.R.Met.Soc.

LEICESTER, 1885.

President.—PROF. F. DE CHAUMONT, M.D., F.R.S.

Presidents of Sections.

Section I.—Arthur Ransome, M.A., M.D., F.R.S.
„ II.—Percival Gordon Smith, F.R.I.B.A.
„ III.—William Marcet, M.D., F.R.Met.Soc., F.C.S. F.R.S.

Honorary Local Secretaries—W. E. Buck, M.A., M.D., and A. H. Paget, A.R.I.B.A.

YORK, 1886.

President.—SIR SPENCER WELLS, Bart.

Presidents of Sections.

Section I.—Prof. F. de Chaumont, M.D., F.R.S.
„ II.—Baldwin Latham, M.Inst.C.E., F.R.Met.Soc.
„ III.—William Whitaker, B.A.. F.G.S.

Honorary Local Secretary—S. W. North, M.R.C.S.

BOLTON, 1887.

President.—RIGHT HON. LORD BASING, F.R.S.

Presidents of Sections.

Section I.—Prof. J. Russell Reynolds, M.D., F.R.S.
„ II.—Prof. T. Hayter Lewis, F.S.A., F.R.I.B.A.
„ III.—Prof. A. Dupré, PH.D., F.I.C., F.C.S., F.R.S.

Conference of M.O.H.—Prof. W. H. Corfield, M.A., M.D.

Honorary Local Secretaries—R. G. Hinnell, E. Sergeant, L.R.C.P., M.R.C.S., and Marshall Robinson.

WORCESTER, 1889.

President.—G. W. HASTINGS, M.P., J.P.

Presidents of Sections.

Section I.—GEORGE WILSON, M.A., M.D.
" II.—HENRY J. MARTEN, M.INST.C.E.
" III.—J. W. TRIPE, M.D., F.R.C.P. F.R.MET.SOC.
Conference of M.O.H.—PROF. W. H. CORFIELD, M.A., M.D.

Honorary Local Secretaries—W. STRANGE, M.D., and HORACE SWETE, M.D.

BRIGHTON, 1890.

President.—SIR THOMAS CRAWFORD, K.C.B., M.D.

Presidents of Sections.

Section I.—G. VIVIAN POORE, M.D., F.R.C.P.
" II.—PROF. T. ROGER SMITH, F.R.I.B.A.
" III.—WILLIAM TOPLEY, F.R.S., F.G.S.
Conference of M.O.H.—ARTHUR NEWSHOLME, M.D., D.P.H.
Conference of Inspectors of Nuisances—ALFRED CARPENTER, M.D., M.R.C.P., D.P.H.

Honorary Local Secretary—A. NEWSHOLME, M.D.

PORTSMOUTH, 1892.

President.—SIR CHARLES CAMERON, M.D., F.R.C.S.I., D.P.H.

Presidents of Sections.

Section I.—PROF. J. LANE NOTTER, M.D.
" II.—JAMES LEMON, M.INST.C.E., F.R.I.B.A.
" III.—W. J. RUSSELL, PH.D., F.R.S.
Conference of Naval and Military Hygienists—INSPECTOR-GENERAL J. D. MACDONALD, M.D., F.R.S.
Conference of Medical Officers of Health—PROF. C. KELLY, M.D.
Conference of Municipal and County Engineers—H. PERCY BOULNOIS M.INST.C.E.
Conference of Sanitary Inspectors—PROF. A. WYNTER BLYTH.
Conference on Domestic Hygiene—LADY DOUGLAS GALTON.

Honorary Local Secretaries—ALEXANDER HELLARD and B. H. MUMBY, M.D., D.P.H.

LIVERPOOL, 1894.

President.—SIR FRANCIS SHARP POWELL, BART., M.P.

Presidents of Sections.

Section I.—E. KLEIN, M.D., F.R.S.
" II.—G. F. DEACON, M.INST.C.E.
" III.—THOMAS STEVENSON, M.D., F.R.C.P.

Conference of Mercantile Marine—SIR W. B. FORWOOD.
Conference of Medical Officers of Health—CHARLES E. PAGET, M.R.C.S., M.O.H. Salford.
Conference of Municipal and County Engineers—A. M. FOWLER, M.INST.C.E.
Conference of Sanitary Inspectors—FRANCIS VACHER, F.R.C.S.
Conference of Ladies on Domestic Hygiene—THE LADY MAYORESS OF LIVERPOOL.

Honorary Local Secretaries—H. PERCY BOULNOIS, M.INST.C.E., and E. W. HOPE, M.D.

NEWCASTLE-UPON-TYNE, 1896.

President.—RIGHT HON. EARL PERCY, P.C.

Presidents of Sections.

Section I.—Prof. W. H. Corfield, M.A., M.D.Oxon., F.R.C.P.Lond.
" II.—Sir Andrew Noble, K.C.B., F.R.S., M.Inst.C.E.
" III.—W. H. Dines, B.A., F.R.Met.Soc.

Conference of Port Sanitary Authorities—A. Holt Barber.
Conference of Medical Officers of Health—Alfred Hill, M.D., F.R.S.E., F.I.C.
Conference of Municipal and County Engineers—F. J. C. May, M.Inst.C.E.
Conference of Sanitary Inspectors—G. Reid, M.D., D.P.H.
Conference on Domestic Hygiene, The Mayoress of Newcastle.

Honorary Local Secretaries—H .E. Armstrong, D.Hy., and J. W. Hembrough, M.D.

LEEDS, 1897.

President.—ROBERT FARQUHARSON, M.D., F.R.C.P.LOND., M.P., D.L., J.P.

Presidents of Sections.

Section I.—T. Pridgin Teale, M.A., M.B.Oxon, F.R.C.S., F.R.S.
" II.—Lewis Angell, M.Inst.C.E., F.R.I.B.A.
" III.—William Whitaker, B.A., F.G.S., Assoc.Inst.C.E., F.R.S.

Conference on River Pollution—Major Lamorock Flower, F.R.Met.Soc.
Conference of Municipal Representatives—Councillor B. Womersley.
Conference of Medical Officers of Health—Edward Seaton, M.D., F.R.C.P., F.C.S.
Conference of Municipal & County Engineers—Thomas Hewson, M.Inst.C.E.
Conference of Sanitary Inspectors—Peter Fyfe, F.R.S.Edin.
Conference of Ladies on Domestic Hygiene—Mrs. Fawkes.

Honorary Local Secretaries—J. Spottiswoode Cameron, M.D., B.Sc., A. E. Pearson, M.R.C.S., L.R.C.P., W. Spinks, Assoc.M.Inst.C.E.

BIRMINGHAM, 1898.

President.—SIR JOSEPH FAYRER, Bart., K.C.S.I., M.D.Edin., F.R.C.P. Lond., M.R.C.S.Eng., LL.D.Edin. & St. And., Q.H.P., F.R.S.

Presidents of Sections.

Section I.—Alfred Hill, M.D., F.R.S.Edin., F.I.C.
" II.—W. Henman, F.R.I.B.A.
" III.—G. Sims Woodhead, M.D., F.R.C.P., F.R.S.Edin.

Conference of Municipal Representatives—Alderman W. Cook, J.P.
Conference of Medical Officers of Health—John C. McVail, M.D., D.P.H., F.R.S.E., F.S.S.
Conference of Municipal and County Engineers—T. de Courcy Meade, M.Inst.C.E., F.G.S.
Conference of Sanitary Inspectors—W. W. West.
Conference of Ladies on Domestic Hygiene—The Lady Mayoress (Mrs. C. G. Beale).

Honorary Local Secretaries—A. Bostock Hill, M.D., W. Bayley Marshall, M.Inst.C.E. and J. E. Willcox, Assoc.M.Inst.C.E.

Volume XIX.—Part 1.] [APRIL, 1898.

JOURNAL

OF

THE SANITARY INSTITUTE.

CONGRESS AT LEEDS.

(Continued.)

CONFERENCE ON RIVERS POLLUTION.

THE proceedings of the Conference commenced with an address by the President, Major LAMOROCK FLOWER, which was published in the Journal, Part III., Vol. XVIII.

"*The Administration of the Law on River Pollution,*" *by* J. WILLIS-BUND, J.P., Chairman of Worcestershire County Council.

ABSTRACT.

THE advantages of the Rivers Pollution Prevention Act, 1876, were the prohibition of new sources of pollution and compelling existing pollutions to be treated in the best practicable and available way to render them harmless. The way the Act has been carried out, and especially the lax treatment of the Local Government Board, has rendered the Act practically inoperative. It has been directly harmful in leaving the authority to enforce its provisions upon the persons who cause the pollution, and by the 7th section allowing all manufacturers to drain their refuse into sewers, so that the matter to be treated varies in each case and depends upon the chemical effect of the particular refuse. Hence, no general treatment of sewage is possible. Matters are made worse by the various disinfectants Local Authorities use, and a mass of matter is produced that can not be dealt with by the process that might be effectual in dealing with sewage. Hence, many sewage works are a delusion. Another point is that the Local Government Board allows local authorities to deal with their sewage in a partial way: for instance, to treat it so as to delay decomposition; this is very well for the authority that does it, but makes matters worse for the authorities lower down. Two points should be insisted on:

1. That there is no general system of treatment that can be universally adopted, each case requires to be dealt with in accordance with the manufacturing waste and other matters that compose the discharge from the sewers.

2. **No system should be sanctioned by the Local Government Board that does not effectually, as opposed to partially, deal with sewage, and regard should be had to the effect of any treatment on the places lower down the stream.**

"*The Disposal of Sewage in Tidal Estuaries*," by G. SIMS WOODHEAD, M.D., F.R.S., Edin.

FOR some time past the sewage pollution of rivers has gradually been promoted to the position of a Sanitary question of almost prime importance, and now that the various water supplies in the country are being so fully drawn upon, and the difficulty of disposing of sewage is increasing, the question of the pollution of non-tidal rivers has been pressed still more prominently forward. On the other hand, tidal estuaries have come to be looked upon as convenient receptacles for all manner of filth and pollution. From certain standpoints this distinction appears to have some justification, and there can be little doubt in the minds of those who have studied the question of the purification of rivers that it is absolutely necessary to draw a sharp line between the importance of sewage contamination of non-tidal rivers and the contamination of tidal river estuaries, as in the latter, owing to the periodical filling with sea-water there can be no question as to the unsuitability of the water for drinking purposes. Furthermore, the conditions, owing to the more or less rapid rise and fall of the level of the water in these tidal estuaries, are such that the deposition and decomposition of organic matter are scarcely comparable to the same two processes in non-tidal waters.

Owing to the enormously different conditions found in different tidal estuaries it is impossible to give any general statement as to the changes that take place in sewage-fouled waters. I shall, therefore, not attempt to lay down any general rules, but I should like to point out some of the different conditions that obtain in some of our large tidal rivers, as I think that from these we may gather some indication as to what conditions are necessary in different cases, in order that purification may take place, and if we can follow this out in a few typical estuaries, there should be no difficulty in applying special, if not general rules, to various other localities.

AS has been pointed out by Sir Richard Thorne, Dr. Bulstrode and Dr. Klein in the 24th Annual Report of the

Local Government Board, 1894-5, and by Dr. Cartwright-Wood, in a special report to the British Medical Journal, written in June, 1895, the question of sewage contamination of tidal estuaries has something more than a mere æsthetic importance, and Drs. Klein and Wood have found that typhoid bacilli may exist in sea-water for some time—at least a couple of months according to the latter—although they do not necessarily multiply very rapidly. Cholera germs also remain alive for some time; whilst, as reported from time to time, both oysters and mussels have been suspected of harbouring in their shells and mantles infective material which has been productive of either cholera or typhoid.

It is evident then that estuaries in which oysters, mussels, or other shell-fish are laid down, should be free from reproach as regards sewage contamination, especially as at any period such sewage contamination may become also typhoid or cholera contamination. Wherever, then, shell-fish are laid down in a river estuary, the water of that estuary should be judged by the same standard as that by which we judge any sample of drinking water.* Whilst, on the other hand, tidal estuaries in which no shell-fish are laid down, and in which the conditions for purification are fairly favourable, should be allowed a latitude which, in the case previously mentioned, would obviously be inexpedient.

Any one who has taken the trouble to glance over the maps of the various oyster-layings given in the Local Government Board Report, cannot but be struck by the close proximity of many of the sewage outfalls to a number of the oyster-beds in tidal estuaries, and in some cases the oyster layings are so surrounded by sewage outfalls that it is practically impossible for any purification to take place before the sewage-contaminated water comes into direct contact with the oyster beds. In other cases, owing to the small quantity of the sewage passing into the river, and owing also to the distance of the oyster beds from the sewers it will be evident that, under ordinary circumstances, the process of purification may have gone on so far that little sewage would reach the oyster-layings, although the possibility of pathogenic organisms remaining alive and active in the water must still be borne in mind. In other cases, again, it is evident at once that no sewage could, under any circumstances, find its way to the oyster-layings. The water in such estuaries would, therefore,

---

* See Dr. Cartwright-Wood's Report to the "British Medical Journal," Sept. 26, 1896.

were it not brackish or salt, be fit for drinking. In the last case it would, subject to the careful analysis and regular examination, be used for drinking water as at present in the case of many river waters (with the results that outbreaks of typhoid, though rarely, can sometimes be traced to them); whilst in the first case the water would undoubtedly be condemned were its use as potable water suggested. These are the general lines on which, I think, this question should be considered.

Now let us see how far the conditions necessary for the purification of sewage-polluted water are met with in river estuaries.

During my holiday I have been staying near a river estuary in which there is, undoubtedly, a certain small amount of sewage, slightly increased in recent years by the addition of the sewage of a rapidly growing pleasure resort. I refer to the River Conway which, of course, receives the sewage of Conway itself, of a number of small villages higher up the river, of Deganwy nearer the mouth, and of Llandudno in the bay at the back of the Great Orme. I have from time to time looked most carefully for evidence of sewage contamination in the Conway. I have examined the various slack portions of the stream at different periods, and have also examined carefully the mud flats, especially those laid down in these back waters. For the last twenty years I have examined them at least once, and often two or three times a year, and I am free to confess that I have seen no increase of deposit since the extra sewage was thrown into the river, although at certain phases of the tide I have come across evidence of the presence of organic matter, especially at high and low water at neap tides in the river itself. From careful observation I am convinced that on the mud below certain back waters formed by the railroad embankment which runs between Llandudno Junction and Conway and by the wall built opposite Deganwy, there is a slight deposit of organic matter. Similar deposits may be found in the back waters of almost every tidal estuary, and it might appear at first sight that these mud flats should increase in depth until ultimately they might become a serious nuisance. As a matter of fact they do not increase. After observing this fact I was led to examine what takes place in this mud. To begin with, one finds that it is teeming with organic life. In it are growing an enormous number of micro-organisms, many of them—especially those in the deeper layers—anaerobic, which have a great power of setting free sulphuretted hydrogen which, combining with the metals in the mud, give to it its peculiar colour, and under certain conditions its unpleasant odour.

In addition to these are found numerous peptonising organisms, which appear to be acting very rapidly on the solid organic matter. You are most of you well acquainted with the various processes of decomposition brought about by these different micro-organisms, and it is here only necessary to point out that these organisms are under most admirable conditions for the carrying on of their special work.

Assuming that there is a deposition of even a minute quantity of organic matter at each tide we have fresh food-stuff brought every twelve hours. Not only so, but with each tide the various products of these micro-organisms, which, if allowed to be accumulated would ultimately retard the activity of the organisms, are washed away by a large volume of water. During the exposure of the mud at low tides the conditions for aëration are all that could be desired, whilst at high tide the oxygenated mixed river and sea water takes the various products into solution and brings the oxygen into close contact with these products so that substances which are not oxidised by the air alone readily become oxidised in solution. Beyond this, however, it must be remembered that the water in estuaries, containing various salts and bases brought down by the fresh water, offers them to the nascent products of the micro-organisms and in this way such nascent bodies become bound up in stable lime and other salts and combinations.

I have taken this estuary as an example of a rapid stream with a large area of flat mudbanks at some part of its course.

As an example of another form of estuary we might take the Firth of Forth, in which we have practically a large inland sea. Here, owing to the configuration of the land, mudbanks are of comparatively infrequent occurrence; but to make up for this we have an immense volume of well-oxygenated water which rapidly oxydises all matters in solution, whilst the volume of organic matter not in solution bears such a comparatively small proportion to the volume of water that it may for all practical purposes, at present at any-rate, be ignored.

Until quite recent years the Thames has been *par excellence* the despair of sanitary authorities; but lately, owing to the excellent work done by the County Council engineers and chemists, an enormous improvement has taken place in the condition of the waters of the Thames. So great has been the improvement that fish now come miles further up the river than they did ten years ago, and this has been brought about entirely, first, by straining and precipitating the solid organic matter, which is then taken in barges far out to sea and discharged there, and, secondly, by carrying on the process of decomposition already referred to as taking place on the Conway

backwater reaches, but doing this artificially and in a controlled space. It seems absurd to talk about fish living in filtered sewage, as in most water containing any appreciable quantity of sewage the amount of free oxogen is so small that it is insufficient to keep fish alive, even under the most sluggish conditions, but Mr. Dibdin describes an aërated fluid drawn from his "filters" which is capable of maintaining fish alive and active, and I have seen sewage so treated and aërated in which fish have lived and exhibited very brisk movements as long as they were under observation. This being the case, I maintain, and I think that most of you will agree with me, that the first step towards the economical purification of our river estuaries will be to carry on the preliminary processes of decomposition of all sewage matter artificially and under most strict control.

By this means the anaërobic organisms may be made to disarrange the complex molecules of organic matter of which sewage is composed. The peptonising or digesting organisms will throw into solution all solid organic matter, whilst the nitrifying organisms, of which there appear to be a considerable number developed in all decomposing organic matter, will convert a certain portion of the nitrogen compounds into nitrates, these in turn sometimes being reduced to nitrites. The amount of albuminoid ammonia is invariably decreased and there is an increase in the amount of free ammonia. The carbo-hydrates and cellulose appear to be broken down into carbonic acid and into methane gas and other carbon compounds, traces of sulphuretted hydrogen and small quantities of other bye-products. Many of these pass off as gas; the sulphur compounds, if present, may give rise to a certain amount of odour, but in the presence of well oxygenated water these are so rapidly oxidised that they form acids which readily unite with the bases in the water, just as do the nitrates and nitrites, though some of them also appear to combine, in small quantities however, with the free ammonia.

We have here, then, an imitation of what goes on in nature, but just as the conditions under which sewage contamination takes place are unnatural and artificial, so it becomes necessary to assist nature by localising some of the processes and keeping them under control so that they may meet the requirements of special circumstances.

In order to give you some idea of the purification that takes place in a stream containing a considerable volume of water, quite apart from the mere sedimentation—although sedimentation undoubtedly plays some part in removing the solid organic matter—I should like to give you some experiments that were made with a sewage-contaminated water from the River Exe

near Exeter. Taking the water from a point just below the city, and adding a small quantity to broth, and incubating for nine days, it was found at the end of this time that there had been a development of such a number of morbific organisms, that when a certain quantity—2 cc—was introduced under the skin of guinea pigs, or into the circulation of rabbits, the animals succumbed; whilst water taken at a point a mile and a half below this, and after passing over a couple of weirs in which, of course, oxygenation would go on rapidly, when similarly treated and injected gave rise to no ill effects, the animals remained perfectly well, thus affording evidence that the morbific organisms had not developed in sufficiently large numbers to give rise to any morbid changes in these animals. There was thus afforded undeniable evidence of the changes that take place in a flowing river, changes which are also well marked in well oxygenated sea or brackish water.

Dr. S. Barwise (Derby) said he rose to thank Dr. Woodhead for his singularly suggestive paper, at the same time he would like to ask if the author could give a list of the aërobic organisms which liquefy solid albuminous matters. At the present there are two large experiments on the bacterial purification of sewage taking place. At Exeter Mr. Cameron is liquefying the solid matters in his septic tank by means of anaërobic organisms, and at Hendon, Colonel Ducat is splitting up the solid organic matter by means of the aërobic organisms. He regarded the Exeter method as fundamentally wrong, as such substances as H_2S are produced, which have to be oxydized before nitrification can commence; on the other hand, at Hendon liquefaction of solid matter and nitrification took place at the same time. Last week he saw Colonel Ducat's filter, and the crude sewage going on without any preliminary treatment contained ·76 parts of organic ammonia per 100,000, while in the effluent the organic ammonia was reduced to ·09 parts per 100,000, and the nitrogen as nitrates was 2·5 per 100,000. The effluent was fit to be turned into any stream in the country. If Dr. Woodhead could breed for us cultures of aërobic liquefying organisms, which would not reduce nitrates, so that sewage could be seeded with them, another great step in advance would thereby be taken.

Dr. S. Rideal (London) pointed out that the increase in the volume of mud flats in estuaries could not be attributed to sewage, except in isolated and very local cases. The amount of solids present in the sewage, even of large towns, when sedimented in an estuary can only form a very thin film, and evidence of its formation is difficult to find. He further ventured to think that the morbific properties of polluted estuary waters was not usually due to pathogenic or-

ganisms, but rather to the absence of dissolved oxygen, which allowed the anaerobes present to multiply in the nutrient medium forming ammonia and amido-compounds which have toxic effects. In that case pathogenic symptoms produced by the eating of shell fish, or by drinking of water from such sources, would be those of ptomaine poisoning, and not of an infectious character.

Mr. Frank Scudder (Manchester) stated that he had been associated with the late Dr. Angus Smith in an investigation of the mud of the Clyde, and called attention to Dr. Angus Smith's presidential address to The Sanitary Institute Congress in 1883, in which he stated "It was the want of this excess of oxygen that caused confined sewer gases to be so dangerous, whilst the enormous amount of gases coming from decomposing matter such as on the Clyde, seemed to pass away leaving comparatively little effect beyond the disgust and the sickness." "If nature had contrived no method of destroying such seeds of death, populations such as this is would never have grown up. And what is the method? That method is: first, putrefaction, at least he knew of none other, except the concluding portion of the work, viz., thorough oxidation." "As putrefaction seemed not to take place without the action of organisms, he had the idea that it might be arrested by an abundant use of air, and he had some belief that the oxidation took place very rapidly after putrefaction." "When nitrogenous bodies decomposed with an abundance of oxygen, the nitrogen becomes oxidised and nitric acid is formed . . . . when there was an excess of putrefactive matter, oxygen was absorbed and even removed from the nitrate, whilst free nitrogen was given off." Mr. Scudder detailed experiments carried out in Dr. Angus Smith's laboratory verifying these processes, and proceeded to quote Dr. Angus Smith as follows: "It was clear, then, and beyond all cavil, that rivers could purify themselves in time, and organic matter might be thoroughly removed. It was clear that organic substances, that germs of disease, that microbes, and the smallest organisms themselves were all subjected to that universal and unsparing attack of putrefaction and oxidation. Let them consider the number of polluted liquids which passed from the houses and hospitals from such a city as Glasgow, and the fact that so many of its inhabitants went down to the banks of the Firth, towards which the waters of the Clyde flowed, and received their health and strength for themselves and their families, and they should see how absurd the ideas had been concerning the power of individual germs, or even multitudes of germs in such situations." Mr. Scudder contended that Dr. Angus Smith had anticipated the principal views put forward by scientific men during the past five years, as to the disintegration of sewage matters. Mr. Scudder admitted that it was very difficult to differentiate between sewage mud and ordinary offensive river mud. The discordant opinion of experts may to some extent be explained by the geological formation of the bed of the river. In 1889 he made a chemical examination of the foreshores and mud deposits of the River Thames and its Estuary, and the conclusions arrived at as to

contamination by sewage were borne out by an independent microscopical examination directed to the detection of matters of an undoubted sewage origin such as muscular fibre, spiral vessels, minute human hairs, woollen and cotton fibres, hairs of oats, &c.

Mr. W. Whitaker (Croydon) said that the discussion so far had been entirely on the bacteriological aspect of the question, but the physical has also to be taken into account. He referred to the physical differences in various estuaries as likely to have a great influence on the amount and character of the deposit, and instanced the deposit in the River Thames, as shown in the evidence given before the Royal Commission on Metropolitan Sewage Discharge, 1884.

Dr. Woodhead (London), in reply, said that he referred especially to one type of estuary—the Conway. That there was great difficulty in differentiating between sewage deposit, and deposit of the decomposing organic matter, these being practically the same, in different stages.

"*Pollution of Rivers from an Engineer's point of view*," by REGINALD E. MIDDLETON, M.Inst.C.E., M.Inst.M.E.

(Fellow.)

Rivers and streams appear to have been regarded from two separate and antagonistic standpoints, namely, as sources of water supply and as receptacles for refuse. It is the business of the engineer to endeavour to reconcile these conflicting elements, to provide from these sources water for dietetic, sanitary and business purposes, which shall not as a *sine quâ non* be injurious to the health of those who use it, while it shall be as well adapted as circumstances will permit for culinary, cleansing and business purposes.

This appears to be the first duty of the engineer, to which must be subordinated the necessity for providing some means, neither too costly nor too intricate, for the disposal of the refuse of the population living within the watershed of the river under consideration.

The word refuse includes much vegetable, animal and mineral matter which does not, as a rule, find its way into any river, but, for the purposes of this paper, it may be taken to mean all matter except water, which finds its way into any sewer or which is deposited in or on the banks of any stream or ditch communicating with the river, and is liable to be carried into

the main stream during times of flood, and the droppings of cattle must, though to a very limited extent, be included in the expression.

No water is, in its natural state, pure, even the rain falling on moor and uncultivated lands collects some impurities from the air, and others from the rocks, soil and vegetation through or over which it passes. Some of these impurities may be injurious to health or may render the water unsuitable for culinary, cleansing or business purposes, but it is not necessary to consider these possible evils at the present moment, the real standard of all town and village water supplies being based on the suitability of the water for potable purposes, whether or no it can be used without danger to health.

Leaving mineral impurities out of consideration the question to be answered is, has the water under consideration been at any time the vehicle for animal or vegetable pollution which might carry disease, and if this question must be answered in the affirmative, have time, sunlight, aeration or other causes removed the dangerous elements to such a degree that the water, having been filtered through sand, can be used by the public without further treatment and with absolute safety.

It has been repeatedly stated that the public generally has a sentimental objection to the use of water which has been at any time contaminated by its passage through the human or animal body. If this be true the public mind is much more fully developed on this subject than on any other, nor do facts seem to support this view, otherwise we should not find the culpable carelessness which exists in connection with the cleansing of cisterns, the perfect indifference with which wells are allowed to be contaminated by leaking drains, nor should we see water drawn from an obviously polluted source when pure water might be obtained with a little extra trouble.

So long as the water used appears to be clear and there is no unpleasant taste about it, it is believed the public is perfectly indifferent as to its source.

It has been suggested that because the germs of typhoid have been carried underground for a considerable distance, and because water drawn from a bed of sand in vessels of more than doubtful purity and from ground probably in itself highly contaminated, sand filtration is not an efficient protection. Sand filtration worked on the same system, that is to say, by passing the water through sand which cannot be re-oxygenated, which may be contaminated in itself and without reference to the rate of flow, will not afford a reliable protection, while filtration, carried on on a proper system, has been shown by experience to be effectual.

It does not appear to be the business of the engineer to decide on the chemical standard of purity to be observed, but it is his duty to study both the history of the sources of supply so as to judge of the probable pollution or otherwise of the water and to confirm his investigations by chemical, microscopical and biological observations, which, although they may be and generally are inconclusive in themselves, whether taken together or separately, are yet, when considered in conjunction with the history of the river, the best evidence which our present knowledge of the subject can afford.

In the watershed of any river there are numberless sources of pollution, the importance of which it must be the duty of the engineer to weigh carefully.

Primarily there are the towns and villages situated on its banks and on the banks of tributary streams, each of which has to dispose of its sewage in some manner or another. The Rivers Pollution Act 1876 provides that sewage shall not be delivered into any stream unless through a channel constructed or in course of construction at the passing of the Act, or where the Court decides that the best practicable and available means of dealing with the sewage of any locality have been employed. This provision is so elastic that it has been next to impossible to enforce the purification of sewage matter in an efficient manner, unless the authorities themselves were anxious to deal with it. Moreover, the Act only provides for the purification of the sewage in cases where it is discharged into a stream, therefore a town, the whole of the drainage of which passed into cesspits, although these might be sunk in open gravel which was full of water finding its way into the river, would be exempt from the provisions of the Act.

Many towns are so situated that the acquisition of land suitable to be laid out as a sewage farm to be worked on a system of broad irrigation is difficult or impossible, land which is liable to be flooded, that which lies close to the river and is exceedingly permeable, or heavy clay land, being, each of them, equally unsuited for the purpose, while, if pumping has to be resorted to in order to obtain access to ground of suitable character and lying at a higher level than the town, an added expense has to be met.

Where resort is had to a system of intermittent filtration the ground must be thoroughly adapted to its purpose, that is to say, it must be sufficiently porous to allow of the sinking of the sewage through it with fair rapidity, while it must not be so porous that the sewage can pass through it without being clarified. The surface of the ground must not be allowed to clog nor must the sewage be ponded upon it.

No chemical treatment of sewage is by itself, it is thought, sufficient to produce an effluent of satisfactory purity.

Too frequently the area of the sewage farm, whether it be adapted for broad irrigation or intermittent filtration, is only sufficient to deal with the dry weather flow, so that in case of heavy rain the ground becomes super-saturated and is unable, both from its dampness and from its limited area, to purify the sewage which is put upon it, nor will the vegetation growing on it take up more moisture, and under these conditions the effluent passes into the river in an unsatisfactory condition.

It may be said on the other hand that the river is itself largely increased in volume by the rains, and the consequent dilution is sufficient to counteract the ill effects of the increased pollution. This however is scarcely a sufficient answer, for it is rather the intensity of the pollution than its proportion that matters, and any flooding will probably wash into the river other pollutions which would not find their way into it during dry seasons.

It appears therefore that the sewage disposal works of any town should be designed to deal in an efficient manner with the largest amount of sewage matter which can be put upon them.

All sewage matter may be efficiently treated by filtration through sand and gravel, in the same way as water is filtered, though at a slower rate and with more frequent periods of intermission.

The Local Government Board has, it is understood, set its face against this system of treating sewage, unless it be supplemented by an area of land sufficient to purify the sewage, should the filter beds break down.

At first sight this appears to be a short-sighted policy, but the reason for it is not far to seek.

No doubt the Local Government Board is satisfied that sewage can be filtered efficiently when the filters are worked with the same care and attention as in the case of a large and important water supply, but anyone who has been in the habit of visiting sewage works must be aware that such attention is quite exceptional, while many sewage disposal works might as well never have been constructed for all the good they are. Sewage tanks where the sewage flows in and flows out again in the same condition, full of putrid and evil-smelling matter, filtration areas so sodden that the sewage will not sink through the ground, and farms where the sewage is only passed over the land when it happens to suit the convenience of the farmer, and at other times lies in pools or flows away untreated, are common.

Villages and small authorities are not in a position to pay for

careful management, they do not get it, and the streams and rivers are polluted in consequence.

There is another form of pollution which is even more difficult to deal with than ordinary sewage, namely, trade refuse; its volume is frequently very large, and it is often of a very offensive character. In one respect this is an advantage, for the nuisance is more easily proved, and it appeals to the senses to such a degree that there is less difficulty in getting the act enforced than is the case where ordinary sewage is in question.

The amount of purification which results from oxidation and from plant life in any river cannot be clearly defined, it appears to vary according to the amount of plant life in the river, but if a stream into which sewage has been poured be followed down its course it will be seen that the water becomes gradually clearer and the vegetable life cleaner. It may be taken as an axiom that there is a constant and continuous effort of nature to purify and to return to the *status quo*.

It is impossible to deal with pollutions in detail in the scope of a paper of this character, but it may be briefly stated that the smaller pollutions produced by scattered buildings are seldom so important relatively as those which are collected together, they are, as a rule, only passed into the river during floods and in the meantime they may have been to a large extent rendered innocuous by dessication.

Much may be done by persuasion in the direction of preventing pollutions, but it seems desirable that the Rivers Pollution Act, 1876, should be strengthened, and that the necessity for the supply of pure water should be more strongly enforced than can be done under the Acts of 1875 and 1878. A supply of pure water should precede sewerage works, not come after them.

The Mersey and Irwell Act, 1892, and the Thames Conservancy Act, 1894, have been prepared with the object, *inter alia*, of giving increased powers to the authorities interested in dealing with pollutions, and there does not seem to be any reason why these powers should not extend to the whole country.

The Rivers Pollution Prevention Act, 1893, also contains the following clause, which is much more stringent than the similar clause in the Act of 1876:

"Where any sewage matter falls or flows or is carried into any stream after passing through or along a channel which is vested in a Sanitary Authority, the Sanitary authority shall for the purposes of Section 3 of the Rivers Pollution Prevention Act, 1876, be deemed to knowingly permit the sewage matter so to fall, flow, or be carried."

Clauses 93 and 94 of the Thames Conservancy Act, 1894, read as follows, and if acted on are sufficiently stringent.

93.—"If any person does any of the following things—namely:—

(1) "Opens into the Thames or into any tributary, any sewer, drain pipe or channel whereby sewage or any other offensive or injurious matter, whether solid or fluid, shall, or is likely to flow or pass into the Thames or into such tributary;

(2) "Wilfully causes or without lawful excuse (the proof whereof shall be upon him), suffers any sewage or matter aforesaid to flow or pass into the Thames or into any tributary down or through any sewer, drain pipe or channel not at the passing of this Act lawfully used for that purpose;

"he shall for every such offence be liable to a penalty not exceeding fifty pounds.

94.—(1) "Whenever any sewage or matter aforesaid is caused or suffered to flow or pass into the Thames or into any tributary, then, and in every such case, even though such sewage or matter aforesaid had been lawfully so caused or suffered to flow or pass before the passing of this Act, the Conservators shall give notice, in writing, to the person causing or suffering the same so to flow or pass, requiring him within a time to be specified in such notice, but not being less than three months, to discontinue such flow or passage.

(2) "Provided that the Conservators may, if they think fit at any time, and from time to time extend the time specified in such notice by another notice in writing.

(3) "And provided that if any person to whom any such notice is given thinks himself aggrieved by reason of the time allowed, either by the original or by any subsequent notice not being sufficient, he may, not later than one month before the expiration of the time so allowed, by writing delivered to the secretary, demand an extension of such time, and in case the Conservators refuse to comply with such demand, the question of such extension shall be referred to an arbitrator appointed by agreement, or failing agreement by the Board of Trade, on the application of either party.

(4) "Any person to whom any notice is under this section given by the Conservators shall, notwithstanding anything in any other Act, within the time allowed by such notice, subject to any extension of such time as in this section provided, discontinue the flow or

passage of the sewage or matter to which the notice refers, and in default of so doing shall be guilty of a misdemeanor and be liable, on summary conviction thereof, or on conviction thereof, on indictment, to a penalty not exceeding one hundred pounds, and to a daily penalty not exceeding fifty pounds.

(5) "Provided that, notwithstanding anything in this Act or in any Act incorporated therewith, any proceeding in respect of such a misdemeanor may be removed by *certiorari* into the High Court."

Mr. H. Alfred Roechling (Leicester) said he should like to draw attention to one paragraph in the paper, so as to avoid its being misinterpreted. Mr. Middleton had said: "All sewage matter may be efficiently treated by filtration through sand and gravel, in the same way as water is filtered, though at a slower rate and with more frequent periods of intermission." This might be understood to mean that sewage-works filters were like water-works filters in their action, and that you could purify sewage by filtering it through water-works filters. This was not so. In water-works filters—as now understood—you aimed at sterilization, you constructed water-works filters as much as possible germ-tight, and if the filtrate showed a large number of germs it was condemned. The filtering medium was very fine sand, and on the top of it formed during the process of filtration a thin layer of slime which increased the germ-tightness of the filter as in its exceedingly fine meshes were caught a vast number of germs of the raw material, reaching into many millions. This slimy skin prevented the access of air to the pores of the filter, and in fact air was carefully driven out by filling the filter at the commencement of a filtering period from the bottom. There was therefore no chance for bacteria to carry on their work, hence came the generally acknowledged fact, that the chemical purification in a water-works filter was practically nil. In a sewage-works filter the conditions were reversed, everything there was done with a view to allowing the air to penetrate right through the body of the filter, so that the numberless germs could carry on the work of purification under the most favourable conditions. The consequence of this was that you had a large amount of purification in a chemical sense in a sewage-works filter, when well managed, but at the same time also millions of germs in the effluent. As both the construction of these two kinds of filters (fine filtering material—coarse filtering material), and the conditions under which they worked (without air—with air, continuous flow—intermittent flow) were totally different—almost diametrically opposite—it was but natural that the results should also be very different. It would be clear from this that a water-works filter would not purify sewage to any extent, and that such a filter could not well be worked on the intermittent, but must be worked on the continuous slow principle.

"*Conditions for the Preliminary Treatment of Trade Waste Water before its Admission into Public Sewers*," *by* H. MACLEAN WILSON, M.D., B.Sc., Chief Inspector West Riding Yorkshire Rivers Board.

A BURNING question in the West Riding at present is that of the admission of trade waste waters to the public sewers, and the conditions of preliminary treatment to be imposed by sanitary authorities upon the manufacturers. In opening a discussion upon this subject it is not my intention to enter upon the legal difficulties of the question. It will be sufficient to take the view that it is only reasonable on the one hand that the sanitary authority shall give facilities for enabling manufacturers within their district to drain the liquids proceeding from their manufactories, or manufacturing processes, into the sewers, where such liquids do not affect prejudicially the treatment of the sewage, and where their admission does not interfere with the water rights of other manufacturers on the stream from which they are abstracted; and, on the other hand, that the manufacturers shall use the best available means to remove from their trade wastes, before discharging them into the sewers, everything which would interfere with the efficient treatment of the mixed sewage.

In manufacturing districts generally, and especially in many parts of the West Riding, the well-being of the urban districts depends almost entirely upon the manufactories, which directly or indirectly contribute a large portion of the rates. It is true that there are many of these manufactories which do not discharge any liquid waste, and in these cases the manufacturer cannot call upon the sanitary authority to dispose of any solid waste matter resulting from his trade processes. It would not therefore seem to be just that the manufacturer whose trade waste happens to be in a liquid form should have the absolute right to cast the responsibility for its disposal upon the public. And, moreover, while it is only reasonable in many cases that the sanitary authority should assist the manufacturer in the disposal of his liquid waste waters, a little consideration will show that it would be impossible for the authority to receive into their sewers and to treat, along with the domestic sewage of their district, crude trade waste liquids of any and every kind. Provision has indeed been made in the various Acts dealing with river pollution, enabling the authority to prevent the discharge into the public sewer of certain classes of liquids, and these Acts would seem to give the authority the power,

although it is not expressly stated in any general Act, to insist that the manufacturer should, before obtaining admission to the sewer, use some means of preliminary treatment in order to deprive his trade waste waters of any properties which would prejudicially affect the treatment of the combined sewage. A considerable number of sanitary authorities, at present engaged in the elaboration of new schemes of sewerage and sewage disposal, are making terms with the manufacturers in their districts, allowing them to drain trade wastes into the public sewers after some such preliminary treatment. The manufacturers in these districts also are recognising that this demand on the part of the Sanitary Authority is a reasonable one, and thus in the present uncertain condition of the law on the matter satisfactory compromise is being arrived at.

There are certain classes of trade waste waters which, if admitted to the public sewers and mixed with the domestic sewage, render the treatment of the combined sewage extremely difficult and expensive; while the increased difficulty and expense are obviated to a great extent if the trade liquids are subjected to some preliminary treatment before being mixed with the domestic sewage. Amongst such trade liquids in the West Riding, the most important are:—

(*a*) The suds from mills in the silk and wool trades, and more especially the suds from the process of wool washing.
(*b*) The discharges, from certain classes of mills in the wool trade, which contain a large amount of fibrous waste.
(*c*) The waste from Tanneries and Fellmongeries.
(*d*) The waste from Breweries.
(*e*) The waste from Paper Works.

When such liquids are received into the public sewers it is, therefore, reasonable that the manufacturer should be obliged to construct works for their preliminary treatment.

Provision of Settling Tanks.—In all the above cases the provision of settling tanks should be insisted upon, and on a moderate estimate the tanks should be of sufficient total capacity to contain half a day's flow of the trade waste. These tanks should be arranged in duplicate, so that while one half is being cleansed the other half may be used. As most mills are only working by day, it will be nearly always possible even with tanks of this capacity to allow some time for the settlement of the tank contents.

A tank on the "continuous flow" principle, with arrangements for discharging the sludge by means of the head of water in the tank, may be substituted for the duplicate tank.

The tanks should be provided with special means for draining

off the top water and for removing the sludge, and sludge filters or presses will be necessary additions. The tanks should moreover, be so constructed as to facilitate the deposit of the solid matter in the liquids,—must be, in fact, constructed in a similar way to the tanks ordinarily employed for sewage disposal. Scum boards, by which floating impurities can be arrested are also required in most cases.

Straining and rough filtration.—In some of the trade wastes there are substances to be removed which cannot be got rid of by simple settling. The flock and fibre from mills in the wool trade are often a source of great trouble at sewage works, and the ordinary grating usually provided at mills is far from being efficient in preventing their escape. In some cases an arrangement of spikes over which the waste water is made to flow and on which the fibrous matter becomes entangled, in others a perforated copper strainer from which the fibrous matter is swept by a revolving brush, is found effectual. It may be well to point out that the adoption of some such method often results in a great saving to the manufacturer. At many mills much good material is wasted by being allowed to escape by the drain. At one of the sewage works in the West Riding the manager boasts the possession of a suit of clothes which has been manufactured from the locks of wool which have been carried down in the sewage.

Spent hops and floating grains in brewers' waste waters also require special means to prevent their being carried beyond the settling tanks, and for this purpose the provision of a strainer or rough filter of engine ashes or coke breeze may be found useful.

Chemical Treatment.—Certain of the above liquids are from their putrescibility very liable to cause a nuisance when discharged, after simple settling, into the public sewers, and in such cases some chemical treatment is necessary. The tanners' and brewers' waste waters both come into this category, and for such liquids, chemical precipitation is necessary to help the deposition of solid matters and to check the fermentation which would otherwise be produced within the sewer. In the case also of the suds from mills employed in the silk and wool trades, the grease should always be recovered before the waste water is discharged into the sewer. The process, fortunately, is an inexpensive one, and the grease recovered may be made to pay to some extent for the erection and working of the requisite plant.

Temperature.—Trade wastes which are at a high temperature when discharged from the mill should on no account be allowed admission to the public sewer without being previously cooled.

The Public Health Amendment Act empowers a Sanitary Authority to prevent this admission.

Volume.—It will be obvious that the volume of the waste waters discharged into the sewer should be reduced as far as possible. For instance, no water used simply for condensing, no surface water from the roofs of the mills, and in breweries no water used only for cooling purposes should be admitted into the public sewer.

Time of Discharge.—In all cases the Sanitary Authority should be able to regulate the time of discharge from the tanks provided at the mills within their district, so that all the mills will not be discharging large amounts of waste water into the sewers at the same time. In the case of works discharging acid liquids, such as waste pickle from works in the iron trade, the sudden rush of acid when the pickle tank is emptied should be prevented, and this may be done by regulating the size of the pipe through which the tank is discharged into the sewer. Allowed to escape slowly such trade waste is often helpful, instead of harmful, to the treatment of the sewage.

Inspection.—For the convenient inspection of the liquids actually discharged from the mill into the sewer, a man-hole or other opening should be provided on the course of the mill drain, and officers of the Authority should have the right to take samples at this point at any time. These officers should also be entitled to inspect the tanks and other works thus provided for the treatment of the trade wastes at any reasonable time, in order to ensure the proper care of the works by the manufacturer.

Approval of Plans.—The plans of such works should be submitted to the Sanitary Authority for their approval before the mill drain is connected with the public sewer.

These seem to be reasonable conditions to be imposed by Sanitary Authorities upon the manufacturers, and they have moreover already been accepted, without demur, by both Sanitary Authorities and manufacturers. In some cases, indeed, the manufacturers have without compulsion put down works more extensive than the above before asking the Sanitary Authority to receive their trade wastes into the public sewers.

The processes even in mills employed in the same trade vary so greatly, and the resulting trade wastes are of such different degrees of strength that it is impossible to lay down conditions which are applicable to every case, and it is therefore necessary that each case should be considered on its own merits; but the above conditions may, it is hoped, be some guide to what ought to be required if Sanitary Authorities are not to be unduly hampered in the disposal of the sewage of their districts.

Mr. J. H. Cox, (City Surveyor, Bradford) stated his experience of the great difficulty in dealing with a mixture of trade effluents and domestic sewage. In Bradford about 370 tons of greasy wool are washed daily. This often contains 60 per cent. of grease and sandy material. The sludge from the combined sewage contains 98 per cent. of water moisture. Bradford has obtained legal power to compel wool combers to remove grease from their waste water, and dyers to remove solid matter. In the case of the wool combers, the Corporation contributes one half of the cost of the grease recovery plant which then becomes a landlord's fixture. The cost is about £36 per "comb." The total expense to the Corporation may be £10,000, but this will result in an actual economy. There are 62 wool combing firms in Bradford, 32 of these discharge their "suds" in a crude form. The Compensation Clause in the Act applies to the latter only, whose names are contained in a Schedule appended to the Act. The penalty for offences against the Act is £20 and 40s. per diem for continuing offences. It is difficult to foretell how the Act would work, but he was of opinion that the recovery of the grease would recoup the wool-combers for the cost of laying down and working the plant.

Dr. J. Spottiswoode Cameron (Leeds) said he had been asked by Dr. Wilson to state the position which the Corporation of Leeds had adopted with respect to trade effluents, Section 7 of the Rivers Pollution Prevention Act, 1876 (requiring Sanitary Authorities to receive manufacturing effluents into their sewers) except "any liquid . . . which would, from its temperature *or otherwise*, be injurious in a sanitary point of view." Section 17, Public Health Amendment Act, 1890, prescribes a penalty for any person who introduces into a sewer "any chemical refuse . . . which, either alone or in combination with the sewage, causes a nuisance or is dangerous or injurious to health." The words "temperature or otherwise" in the Prevention Act might probably therefore, without straining, be applied to any effluent likely to cause a nuisance by its entrance into the sewers. The refuse from leather works, inasmuch as some of it is still in a fermenting condition, might on coming in contact with sewage set up a rapid evolution of noxious gases. The Leeds Corporation require in the case of such works that, after settling and straining, the effluent should pass through a man-hole with a tell-tale by which any objectionable matter allowed to escape might be detected. The certificate of the Medical Officer of Health that the effluent is fit to pass into the sewers is required. The man-hole and tell-tale are required for all manufacturing effluents now admitted into the sewers. His relations with the manufacturers had been exceedingly pleasant. They recognised that he was acting in the interests of public health, and he put no unnecessary difficulties in their way.

Mr. Malcolm Paterson (Bradford) remarked upon the difficulty of

getting six hours' storage for trade refuse in many cases—the washing scouring and dyeing machines being at the lowest level of the works, and it being a necessity that practically in most cases the surface of all storage must be five feet below the lowest floor of the factory. He had found it difficult enough to get even a two hours' storage in one case. He quite agreed that the grease should be extracted in all cases whether it paid to do so or not. As to temperature—powers to prohibit admission on this score, after lying dormant for nearly a generation, should be cautiously exercised. Waste water used for washing-off might be greatly reduced, much of it being fit to discharge direct into the river, but such discharge must depend upon the care and intelligence of the man in charge, who would turn the valve off and on as he thought fit. No automatic control was possible. In many cases dye waters might be discharged direct into sewers without settlement, if taken at all by the authority, there being little weight of sediment. Users of sewers for trade effluent should not be allowed a right to the prejudice of other rival firms, competitors in trade. All should be on one level so far as possible. This he stated in reference to what had been done in Bradford, where the past use of sewers for trade effluents had created a right denied to the new-comers.

Alderman T. W. Harding (Leeds) stated that the question was still in its infancy, and sanitary authorities were only just beginning to realise their position and responsibility. The uncertain state of the law was one great difficulty. This was not so much a legal as a practical question, and the only reasonable way out of the difficulty was for the manufacturer and the Sanitary Authority to confer and come to a practicable agreement. In many cases there might be an absolute pecuniary gain to the manufacturer; for instance, coal dust deposited in washing tanks soon repays the initial outlay. This was also the case when fibre was deposited from paper works.

Dr. G. H. Fosbroke (Worcester) said, by direction of the Worcestershire County Council, he had just been reporting upon the extent to which waste acid from metal works turned into streams was injurious to health and as to what practicable means were available for preventing the pollution of rivers and streams from this cause. He considered it unnecessary to describe the galvanising process, as this was probably known to most if not all present. He found that the Worcestershire manufacturers preferred muriatic acid to sulphuric acid, because it was cheaper and did not act too quickly on the skin of the metal. Comparatively few of these manufacturers treat their waste acid, or pickle, but discharge it into rivers untreated, tip it on cinder heaps or throw it down disused pit shafts. After making many enquiries and visiting numerous metal works in various parts of the county, he was convinced there was no evidence to support the view that the discharge of waste acid into streams was injurious to health, although he did not think such a thing should be tolerated, as it destroyed fish and injured boilers. Where sulphuric acid was used manufacturers could get some return for treating their

pickle by recovering the sulphate of iron, but with muriatic acid, in his opinion, the best method of treatment was to neutralize the acid with lime, soda, or ammonia, and after allowing the sludge to deposit, then run off the supernatant liquor, care being taken that the effluent was neutral. As the cost of treating muriatic pickle was considerable, and manufacturers were often, either directly or indirectly, large ratepayers, he thought local authorities would be well advised, while protecting the general interests of their districts, to afford such traders every facility for the development of local industries. If pickle was turned into sewers where the volume of sewage was small in proportion to the volume of pickle, then neutralization was imperative, and means of access to the effluent pipes from the pickle tanks should be available for inspection, or better still the actual emptying of the tanks should be entrusted to some official of the local authority. On the other hand, if the volume of pickle was small as compared with the sewage, then he thought that the pickle might, *on terms*, be discharged untreated into the sewers, provided that such discharge was under the control of some authorised official, who would make arrangements for the pickle to reach the sewers when the volume of sewage was largest, *i.e.*, in the morning, and in something like equal quantities from day to day, special care being taken to prevent rushes of acid. He was supported by the manufacturers in the view that it would be practicable to prevent such rushes. In Birmingham, where the whole of the crude pickle was passed into the sewers, he found that in only two instances were the sewers damaged. If Local Authorities assisted manufacturers in this way, it was only reasonable for such traders to make special contributions.

Alderman SCHOFIELD (Rawtenstall), said that having listened very attentively to the remarks of the various gentlemen who had spoken on this subject, he found that they all seemed to have treated the matter from a Yorkshire stand-point. He begged leave to differ from these gentlemen, and to state his case from a Lancashire stand-point, as conditions varied in different districts. Being a Member of the Haslingden, Rawtenstall, and Bacup Joint Outfall Sewerage Board, representing a population of 80,000, and an acreage of 20,000 acres, he had had the pleasure a week previous to the Congress of moving a resolution at that Board (namely) "That we do not admit manufacturers' trade refuse or trade liquids into any of our sewers having their outlet at the Joint Outfall Works," and the motion was carried unanimously. In Lancashire, mills and large works of various kinds were built upon the banks of the rivers, from which they drew their water supply, the flow of water was only of a limited quantity, and each manufactory was dependent on its neighbour to a certain extent to return to the river the water they have received after having utilised the same for trade purposes, and this was carried on to a distance of twenty miles along its banks, until it entered the Ship-Canal at Manchester. If they were to adopt in their district the suggestions of the gentlemen that had spoken upon this matter, in times of drought the manufacturers would be at a stand-still

and the trade of the district would be paralysed. It is of paramount importance to them that trade effluents be returned into the rivers and utilized for trade purposes, or otherwise the rivers would be robbed, and the mills and works along their banks hampered. It would be seen that under these conditions it would be a serious matter and very unwise to turn either this water or even surface water into the sewers and rob the rivers of this volume of water for a distance of eight miles. There would be some difficulty in treating this great volume of water at the Outfall Works, and besides this, they would be passing the water into the rivers outside their own Boroughs, having denied their own manufacturers the use of the same and passing it on to their competitors below.

On "Rivers Pollution Work, from a Sanitary Inspector's point of view," by F. T. Poulson, Rivers Pollution and Sanitary Inspector, Staffordshire County Council.

ABSTRACT.

THE importance of the work considered both as affecting the health of communities, ratepayers, and also Trade interests. Tact required to bring satisfactory state of things about. The detective-like element in a Sanitary Inspector's work. The kind of pollutions considered from sewage of rows of private houses, manufactories, and sewage disposal works. Tests employed for detecting pollution. Local sanitary authorities—their officers and general pollutions considered. A description of Staffordshire—its area, rainfall, water supplies, &c., and method of inspections, and the nature of Trades and their waste effluents. The effect of rivers pollution work in causing better drainage and other sanitary arrangements to be provided. The expenditure on sanitary work is well spent. Private or public works established in close vicinity to streams. Culverting streams a means of hiding pollution and rendering more difficult the tracing of such pollution. In what respect Sanitary Inspector differs from detective. Superannuation and tenure of office. Requests from Local Authorities to County Councils to exercise their powers under Rivers Pollution Prevention Act. Absence of friction when traversing districts. Sewage farms and points of observation on streams in Staffordshire where samples are collected for analysis. Canal pollution in Staffordshire. Improvement anticipated in condition of streams following the establishment of new sewage works and the improvement of existing works. River Pollution work a gigantic sanitary lever.

[*For discussion on this paper, see page* 37.]

"*Rivers Pollution Standards*," *by* W. NAYLOR, A.M.I.C.E., F.C.S., Chief Inspector Ribble Joint Committee, Preston.

EVERY person whose lot it has been to take part in the administration of any of the Rivers Pollution Acts must have been confronted with the question "how near to the practicably unattainable pure water ought noxious and polluting liquids to be purified before their discharge into natural streams?"

Into the mind of the person whose desire or duty it is to purify these noxious and polluting liquids the question must naturally arise since he cannot accomplish the *ideal*, and more particularly since every step further taken towards it means additional expenditure both as capital outlay and maintaining cost.

The English manufacturer and his managers are trained in schools where they are taught to economise at every point. To-day, owing to foreign competition, labor strikes, extended employers' liability, increased rates and taxes, and many other causes the trader appreciates the fact that to survive he must not spend any money for which there is no return unless compelled. And when he is compelled he wants to satisfy himself that the money is the least that will suffice. When, therefore, after putting down purification plant, bringing about purification to a certain extent, he is informed that he has not gone far enough, he naturally asks, "How much farther am I to go?"

To reply in the rather vague terms of the Rivers Pollution Act that he must adopt "the best known, reasonable and practical means" is certainly far from satisfying. Like the Jews of old asking for a sign, both local authorities and manufacturers ask for a standard.

The Rivers Pollution Commissioners so far back as 1870 foresaw the difficulty which would surely arise and were bold enough to suggest a standard. On page 130 of their first report, Volume I., the following appears:—

"(A.) In order, on the one hand, to guard the manufacturer against any arbitrary interference of this authority,* and on the other hand to secure an efficient and uniform check upon the pollution of rivers by liquid refuse throughout the country, it will be necessary to prescribe definite standards of purity below which no liquid shall be admissible into any river or stream.

"The following standards have been framed with a due regard to the extent to which the cleansing of foul liquids can be effected without the imposition of undue restrictions upon

* Administrative authority.

the manufacturer, and without 'serious injury to such processes and manufactures' as are carried on in the Mersey and Ribble basins. We do not recommend the adoption of these standards as workable and practical without having ascertained their applicability to the very numerous samples of polluting liquids which have been analysed in our laboratory since 1868. We believe that as science progresses improved methods of purifying polluting liquors will be discovered, and that eventually standards of purity considerably higher than those given below may, if necessary, be enforced; but as the manufacturer is not necessarily an original discoverer, it would obviously be unfair to throw upon him the onus of inventing new and improved processes for producing higher degrees of purification than those easily attainable by methods already known.

"Having in view, then, at present only the chief sources of pollution in the basins of the Mersey and Ribble, and the methods of cleansing now available, we suggest that the following liquids be deemed polluting and inadmissible into any stream:—

(a) Any liquid containing in suspension more than three parts by weight of dry mineral matter, or one part by weight of dry organic matter, in 100,000 parts by weight of the liquid.

"(b) Any liquid containing, in solution, more than 2 parts by weight of organic carbon, or ·3 part by weight of organic nitrogen in 100,000 parts by weight.

"(c) Any liquid which shall exhibit by daylight a distinct colour when a stratum of it one inch deep is placed in a white porcelain or earthenware vessel.

"(d) Any liquid which contains, in solution, in 100,000 parts by weight, more than 2 parts by weight of any metal except calcium, magnesium, potassium, and sodium.

"(e) Any liquid which, in 100,000 parts by weight, contains, whether in solution or suspension, in chemical combination or otherwise, more than ·05 part by weight of metallic arsenic.

"(f) Any liquid which, after acidification with sulphuric acid, contains, in 100,000 parts by weight, more than one part by weight of free chlorine.

"(g) Any liquid which contains, in 100,000 parts by weight, more than one part by weight of sulphur, in the condition either of sulphuretted hydrogen, or of a soluble sulphuret.

"(h) Any liquid possessing an acidity greater than that which is produced by adding two parts by weight of real muriatic acid to 1000 parts by weight of distilled water.

"(i) Any liquid possessing an alkalinity greater than that which is produced by adding one part by weight of dry caustic soda to 1000 parts by weight of distilled water.

"We would here add that whatever authority may be constituted for the future protection of rivers, it should not only be required to direct the observance of any enactment based upon the above standards, being at the same time empowered to enforce the adoption of remedies for proved nuisances wherever the offender is negligent; but it should also be enabled to stay proceedings on the part of those suffering from the nuisance, when satisfied that the offender is honestly trying to abate it. We do not desire that any complaint founded on the existence of a nuisance arising from any of the above offences should be finally silenced, or that any just claim for damages founded on it should be absolutely barred by the mere fact that a scheme for the abatement of the nuisance had received official sanction. But we believe it will be for the general interest that such a sanction should for a time exonerate from legal liability those, whether corporate bodies or individual offenders, who are carrying into operation any scheme thus sanctioned."

I have searched many volumes, English, American, and Continental, for other suggested standards of purity, and apart from restrictions relating to waters to be used as drinking waters wholly and solely, have only found the following suggestions:—

I. Page 12 of a paper by Adolph Gasch: "Still something more about Factory Refuse Water."—*Vienna*, 1889.

"The Government, therefore, in order to preserve the purity of public sewers should forbid—

(1) The drainage of entirely unpurified refuse water.

(2) The drainage of partially purified refuse water:—

(*a*) If direct poisons, such as arsenic, cyanide of potassium, compounds of lead and copper, or free chlorine, &c., are contained in it in ever so small quantities.

(*b*) If it still re-act, acid or alkaline.

(*c*) If it be still putrid or capable of causing putrefaction.

(*d*) If products of the distillation of wood, coal, and petroleum are contained therein.

(*e*) If plainly perceptible dyes are contained in it.

(*f*) If salts, alkaline substances, acids and metallic compounds, and suspended matter are contained in it in larger proportion than 1 to 1000."

II. "Factory effluents," by Hans Benedikt.—*Stuttgart*, 1896. Dr. Benedikt says:—"From the standpoint of public hygiene

it is requisite that the Government officials in enforcing the regulations for the prevention of an injurious degree of pollution of the public water-courses, observe the following principles:—

(1) Injurious pollutions of public watercourses are caused by—

(*a*) Infectious matter.
(*b*) Purtescible matter.
(*c*) Poisonous matter.
(*d*) Other matter which restricts the use of the water of rivers for domestic purposes, in agriculture or in industry, or which endangers the fishing. . . . .

(2) With regard to the effluents included under (*a*) and those from industrial works which do not fall under (*d*) but contain putrescible substances, care has to be taken that such are discharged into public watercourses only in a completely clarified state and are so diluted by the latter that a malodorous putrefaction cannot set in later. . . . .

Provisionally so far as putrescence is concerned the permissible degree of pollution has to be judged by the absence of unmistakable signs of malodorous putrefaction such as the smell and the evolution of bubbles of gas even at the lowest water level. . . . .

(3) Poisonous matters according to the present experience only come into the question as mineral poisons (arsenic, lead and in factory effluents). Very small quantities are innocuous. It is to be taken into consideration that the limit is fixed by experts within which the discharge of such matter into public watercourses is permissible.

(4) Watercourses may be also polluted by other matters than those included under (1) to (3), rendering them unfit for drinking purposes, for domestic uses, for industry, for agriculture, or endangering fishing. This is especially the case with regard to the effluents from dye works, soda, gas and other chemical works, the effluents from paraffin or petroleum works, hot condensation water, chemicals which have served for clarification and disinfection of effluents, &c. The question of the discharge of these effluents into rivers is to be made dependent on a previous purification only, and must be decided by the fact as to whether the river water be not changed to any considerable extent with regard to its clarity, taste, smell, temperature, and quantity of dissolved mineral matter.

Generally applicable statements, such as can be expressed in figures or precisely define the limit, have not yet been arrived at."

Now it appears to me that the standards suggested by the Rivers Pollution Commissioners are vastly superior to the other suggested standards here quoted, and I only purpose in this paper to discuss the applicability of these standards to-day.

No reasonable objection can be taken to the recommendations (*h*) and (*i*) with regard to acidity and alkalinity, as these are quite within the control of the majority of manufacturers, and it is not often that it could be anything but a waste to turn out liquors distinctly acid or distinctly alkaline. In the cases where large quantities of lime are used alone, as in tan yards, the neutralization of the alkalinity by means of sulphuric acids results both in the elimination of a large portion of the lime and of the organic matter.

The amount of solids in solution after neutralization brings us to the recommendations (*a*) and (*d*) dealing with dissolved and suspended matter generally. The limit of three parts mineral matter, or one part dry organic matter, or say a total of four parts per 100,000, is not by any means an unattainable limit, and in the Ribble watershed there are many effluents from bleach, dye, print, paper, chemical and other works, well inside this. A difficulty that arises in connection with this point is, so far as my experience goes, that samples immediately after being drawn are often within the limit, but on standing, as they necessarily must sometimes for a day, or even two, before examination, a deposit of solids takes place, owing to the cooling of the liquid, later chemical reaction, and possibly a change of alkalinity or acidity. These changes in two days often amount to three or four parts per 100,000, and it is possible that, so far as this recommendation is concerned, a limit of time within which samples are to be examined would be advantageous. This limit of time should be made, too, with due regard to the length of time the samples would be before reaching the sea, and the nature of the river into which the effluents are discharged. In cases where there is much damming up of the watercourses there is no doubt that much sedimentation, followed by putrefaction, takes place from effluents presumably good at the time of discharge.

The following samples were examined immediately after drawing, and again after standing in the bottles some considerable time, as shown in the table. From these it will be seen that even from apparently good effluents much sedimentation may be expected. If it be borne in mind that in the Ribble Valley 3 grains per gallon of suspended matter from each of the manufacturers' effluents per day represents a total of 200 tons wet sludge, its importance can be appreciated.

Firm.	Example.	Date.	Dissolved Solids.			Suspended Solids.			Gross Solids.		
			Mineral.	Volatile.	Total.	Mineral.	Volatile.	Total.	Mineral.	Volatile.	Total.
Middleton & Co.	Tank effluent	23 April, 1897 ...	83	48	131	...	...	...	83	48	131
Same re-examined	August	....	88	31	119	0	3	3	88	34	122
Middleton & Co.	Tank effluent	5 June, 1897 ...	118	38	156	4	0	4	122	38	160
Same re-examined	August	....	117	33	150	4	4	8	121	37	158
Ridgway & Co..........	Raw liquor and tank effluent ...	29 May, 1897 ...	66	56	122	16	18	34	82	74	156
Same re-examined	August	....	86	49	135	3	15	18	89	64	153
Whalley, Abbey Co....	Tank effluent	27 April, 1897 ...	47	30	77	1	2	3	48	32	80
Same re-examined	August	....	52	16	68	0	4	4	52	20	72
Scotshaw Brook	Tank effluent	13 May 1897 ...	103	45	148	3	7	10	106	52	158
Same re-examined	August	....	87	18	105	5	18	23	92	36	128
Scottshaw Brook	Tank effluent	20 May 1897 ...	88	48	136	3	5	8	91	53	144
Same re-examined	August	....	96	41	137	0	3	3	96	44	140
Davies & Eckersley...	Tank effluent	29 May 1897 ...	113	103	216	2	1	3	115	104	219
Same re-examined	August	....	119	37	156	8	32	40	127	69	196
Wilson & Son	Raw liquor	3 June 1897 ...	37	160	197	8	14	22	45	174	219
Same re-examined	August	....	51	101	152	0	6	6	51	107	158
Stanning	Tank effluent	9 March 1897...	84	53	137	1	2	3	85	55	140
Same re-examined	August	....	67	27	94	2	12	14	69	39	108
J. T. Holt	Tank effluent	5 May 1897 ...	67	50	117	0	8	8	67	58	125
Same re-examined	August	....	75	21	96	0	20	20	75	41	116
Tootler & Co............	Filter effluent........................	13 May 1897 ...	65	80	145	3	11	14	68	91	159
Same re-examined	August	....	73	32	105	0	12	12	73	44	117
W. Barnes	Tank effluent and other water...	20 May 1897 ...	124	81	205	5	24	29	129	104	233
Same re-examined	August	....	107	50	157	6	4	10	113	54	167

It will be noticed in some of these cases that the suspended matter has actually decreased in amount, probably owing to some biological action.

The recommendation (*d*) suggests no limit to the soluble salts of calcium, magnesium, potassium and sodium.

According to the experiments I made and which are recorded in the Proceedings of the Institution of Civil Engineers, Volume CXXIII., 397 soluble salts of calcium and magnesium above certain limits can be eliminated to a certain extent by filtration through coke or sand, but much difficulty is experienced in dealing with effluents from chemical works and soap works from which filtered waste lyes and other liquids containing salts of soda and potash are turned directly into streams. So far as soda and potash are concerned it can hardly be expected that manufacturers will resort to the recovery of these unless the liquors contain about 30 per cent., whereas an amount much less than this is certainly foreign and possibly, indeed probably, injurious to a natural stream. In the Ribble watershed as much as 5,000 parts per 100,000 salts of soda are to be found in some cases.

This recommendation it may be noted, apart from the idea of sewage contamination, takes no cognizance of the nature of dissolved organic matter which in some cases is high and at the same time easily eliminated. It is not to-day a very profitable matter at print-works to recover soaps, and a large quantity of soluble soaps passes away with dye and print-works effluents often after settling and filtration. In one case, where the waste liquors are passed through very capacious settling tanks and allowed possibly some two days for settlement, afterwards being passed through coke filters, the amount of soluble soaps present is on an average about 5 per cent. of the total solids. These soaps are decomposed by salts encountered in the stream, insoluble lime or metallic soaps being formed, coating the vegetation in and on the banks of the stream, and this though the effluent complies with all the standards of the Rivers Pollution Commissioners containing little or nothing in suspension and about 85 parts per 100,000 total solids, and being neutral in reaction. (Note C, 2 parts per 100,000.)

The recommendation (*f*) is not by any means unattainable, and will probably result in the adoption of improved machinery in the chemicing departments of bleach works, much to the advantage of the manufacturer. At one or two bleach works in the Ribble watershed where the amount of free chlorine in the effluent some three or four years ago was exceedingly high and indeed perceptible in the atmosphere, it has been reduced now

to an almost imperceptible amount, to the advantage of the manufacturer, and where a little free lime is used as precipitant this small amount is fixed.

The recommendation (*g*) is very important so far as the drainage from old alkali tips is concerned. This drainage is undoubtedly a source of pollution and public nuisance. In some cases the drainage is used with the fresh lixivation tank waste and the sulphur so recovered; but there are other cases where works are defunct though the waste tips remain.

That this has a polluting effect on the river there can be no doubt.

I am indebted to Dr. Gerland for the results of a series of trials made with alkali drainage liquor upon animal and plant life when diluted with river water.

The following are the results of Dr. Gerland's investigation:

Accrington, *May 30th*, 1897.

Drainage from Soda Waste at Parbold.

A large sample of the drainage was collected May 14th from the outfall south of the Canal Bridge, for the purpose of ascertaining its effect upon animal and vegetable life in the river, upon which the self-purification of the river largely depends.

Analyses yielded the following results:—

100,000 parts contain—

Sulphuric Acid (SO_4H_2)	132·64
Sulphurous Acid (SO_3H_2)	2·808
Hyposulphurous Acid ($S_2O_3H_2$) ...	4·03
Hydrogen Sulphide (H_2S)	38·20
Sulphur, as Polysulphide	17·42
Lime	120·17
Magnesia...	4·66
Oxide of Cobalt...	0·503
Trace of Soda	—

These may be assumed to be combined as follows:—

Calcium Sulphate	184·076
Calcium Sulphite	27·120
Magnesium Sulphite	12·116
Calcium Hyposulphite	53·732
Calcium Sulphide	26·802
Hydrogen Sulphide	30·965
Sulphur	17·424

Effect of Parbold Liquor upon Animalculæ.

The only species suitable for the purpose that could be

procured at this season were Cyclops (Water Flea)—1 part Parbold liquor, mixed with 1,400 parts of well-aired tap water, with Cyclops. Cyclops became gradually quiet, most of them were dead in half an hour. By exposing the water in a thin layer to the air a few recovered. 1 part Parbold liquor in 700 parts—All life was extinct in quarter of an hour.

Effect upon Lower Forms of Plants.

The plants available were :—Hornwort (Caratophylum demersica); Cara; Moss (Fontinosis antipyretica); Conferva; Duckweed (Lemna minor); Spagnum.

May 21st. One part Parbold liquor to 1,000 parts tap water run in a slow stream into a glass with the water plants exposed to a good diffused light. The plants look fresh, except the Hornwort.

May 22nd. Two parts Parbold liquor to 1,000 parts water. Hornwort is fading, the other plants fresh.

May 23rd. The same solution. The same results.

May 24th. Continued with the same solution. Hornwort appears dead. Cara very much faded.

May 25th. Continued running the same solution over the plants. Cara appears dead. Fontinatis, the moss, turns brown in the older parts; the young points of the shoot are still green. Spagnum and Confervæ look fresh.

May 26th. Twenty parts Parbold liquor to 1,000 parts of water.

May 27th and 28th. Continued with the same liquor.

May 29th. Thirty-three parts Parbold liquor to 1,000 parts of water.

May 30th. Forty parts Parbold liquor to 1,000 parts of water. The browning of Fontinatis has progressed. Spagnum does not look very healthy. Confervæ and Lemna are still thriving. Will be continued.

These trials prove that the drainage from the Parbold waste is fatal to lower animal life, even in great dilution with aërated water, but that its effect on water plants is not so bad.

July 20th, 1897. Parbold Drainage from Soda Waste. Effect upon Water Plants. Second Report.

Since sending you my report on May 30th, I have continued the experiment and herewith beg to state the results. From May 30th to June 2nd the Parbold liquor was diluted with ten times its quantity of ærated water. The plants looked healthy and the Chlorophyll had darkened considerably, giving the appearance of intense vegetation. From the 2nd to the 5th

June the strength of the solution running over the plants was increased to the proportion of four parts of water to one of liquor, and from that day to the 15th June in the proportion of three to two. The green parts appeared still darkening and the plants appeared healthy. Sufficient liquor was left in the store vessel to run for seven days.

On July 15th all plants had died, and although transferred to clean water after thorough washing, none of them has revived. The darkening of the Chlorophyll it seems was the first symptom of disease—probably by the iron of the latter being separated from the molecule. I am thus forced to the conclusion that the water plants may live and thrive in diluted Parbold effluent for a certain time, but that long continued contact with it causes their death.—B. WILH. GERLAND.

The recommendation (*e*) will hardly be questioned by any-one, while (*c*) although difficult of attainment would probably not be enforced if all other recommendations were complied with.

Turning now to (*b*) which refers principally to sewage works effluents, much may be said; to begin with the amount of organic nitrogen and organic carbon in sewage works effluents is rarely ascertained, owing probably to the fact that the examination of effluents by this method is tedious, expensive, and in some quarters even its veracity is questioned.

One of two methods—the oxygen absorbed or albumenoid ammonia liberated—is generally substituted—or both.

Although both these methods have the advantage of expedition compared with the dry combustion method, they have the disadvantage of uncertainty, the results, so far as sewage is concerned at any rate, being only comparative. In the case of the former the oxygen absorbed bears little relation to the total organic matter present, and in the case of the latter the albumenoid ammonia bears no strict relation to the organic matter from which it is liberated.

It is claimed, and no doubt with some truth, that any compounds not decomposed by the permanganate must be of such a stable character that their presence in an effluent is not likely to give rise to trouble, but here again varying time and environment are important considerations.

In tabulating the Ribble Joint Committee results, at one time the practice of giving the Albumenoid Ammonia and Oxygen absorbed (4 hours at 80 degrees Fahr.) was adopted, with the remarkable result that some effluents were to be declared good on the Oxygen Absorbed figure but bad on the Albumenoid Ammonia figure, and *vice versâ*.

To get out of this dilemma a resort was made to the estimation of Oxygen Absorbed during one hour's boiling, as suggested by Dr. Blair,* but although the figures in each of the two columns then bore a remarkably constant relation to each other the method was discarded owing principally to the fact that the figures were of no earthly use for comparison with Oxygen absorbed four hours, and also because the objection of the liberation of chlorine by the permanganate could be raised.

As stated, the principal objection was the uselessness of the Oxygen Absorbed estimations for comparative purposes.

Nothing in my mind tends more to lower the science of chemistry in the mind of the public than experts following each other into the witness box and each decrying the other's method of analysis. So recently as the 21st August the following remarks, quite to the point, appeared in a leading article in the "Chemical Trade Journal":—

"We have dwelt to some purpose in the past upon the urgency of the question of conformity in water analysis, and the growth of River Committees and Purification Boards is bringing this branch of analysis out of the sphere of the laboratory into that of commerce. It is being looked to as an indicator and used as a rudder. The importance of seeking conformity of expression, and also of interpretation, is therefore growing, and we commend the point to the attention of water analysts, because it is unfortunate for the science of analysis that the most inconsistent, often the most inscrutable and the most superficially blemished of all its branches, should be finding its way into such public prominence without any serious attempt at systemising or adjustment."

A point to be observed in connection with the "Oxygen Absorbed" method too, is that the amount varies much more rapidly with time in the same sample than does the albumenoid ammonia liberated. A sample of fresh sewage will absorb less than when (two days later) its organic compounds are less stable and much more easily oxidized.

On this account its value is greater as an indication of the degree of putrescence rather than the amount of organic matter present.

On the other hand if oxidation has really set up and nitrates are present, the oxygen absorbed is greater than on the same sample in a really more polluting condition.

In the Ribble Watershed for ordinary (but not especial) purposes reliance is placed on the albumenoid ammonia liberated.

Many attempts have been made to arrive at a factor for the

* Blair, "The Analysis of Potable Waters."

albumenoid ammonia and the organic nitrogen, but up to the present all have been unsuccessful.

Mr. G. E. Davies, of the "Chemical Trade Journal," and I commenced an investigation some four or five years ago, but no conclusions could be drawn from the results obtained.

As far as could be gathered, however, from a greater number of estimations made by both methods in the Ribble Joint Committee's laboratory the albumenoid ammonia figure nearest to the ·3 Organic Nitrogen standard of the Rivers Pollution Commissioners is ·2 parts per 100,000.

This fact, together with other practical considerations of sewage treatment, has led to the institution of proceedings for pollution in all cases where the albumenoid ammonia has exceeded this amount, and in all cases these proceedings have been successful.

But this estimation, being originally intended for water analysis, leaves a way for much difference of opinion in regard to the manner in which sewage samples should be examined. For two independent persons to obtain concordant results a common method of procedure must be followed.

The first important consideration to be agreed upon is the age of the sample.

In this connection I will venture to quote the case of a difference which occurred in the case of samples of effluent from Ince Urban District. When a complaint was made by the Clerk to the Ribble Joint Committee, accompanied by the albumenoid ammonia figures, a reply was received that the figures differed from those of their own chemist, who was backed up by eminent independent authority.

A deputation was then summoned to appear before the Joint Committee, when it was found that the eminent authority in question received his samples 14, 11, and 2 weeks respectively after the dates of drawing; and further, that in the last of these cases (freshest sample) the agreement was nearer the Ribble figure and not that of the Ince analyst.

So much then for the element of time. Another consideration is the amount of distillate taken off. I believe it is not an uncommon practice to take off only 150 cc.; in fact in a letter received a few days ago a Public Analyst wrote me that on taking 50 cc. of the sample and diluting with about 700 cc. distillate water he generally found that all the ammonia came off in the first 100 cc. of distillate. Without wishing for a moment to dispute this fact, I must confess I never yet met with such a case.

The amount of sample taken before dilution has an important effect on the actual ammonia figure.

On a sample of effluent from Horwich, taken Sept. 6th, the following results were obtained :—

No. 1 Estimation.

50 cc. sample taken and 1 litre distilled water.

The first 50 cc. of the distillate	=	4·0 cc.	weak solution.
The second 50 cc. " "	=	3·2 cc.	"
The third 50 cc. " "	=	2·1 cc.	"
The fourth 50 cc. " "	=	1·5 cc.	"
The fifth 50 cc. " "	=	1·2 cc.	"
Total		12·0 cc.	"
Deduct 3 cc. weak solution for blank		3·0 cc.	"
		9·0 cc., equal to ·180 parts per 100,000.	

No. 2 Estimation.

100 cc. sample taken and 1 litre distilled water.

First 50 cc. of distillate...	=	6·6	cc.	weak solution.
Second " " ...	=	5·0	"	"
Third " " ...	=	3·0	"	"
Fourth " " ...	=	2·0	"	"
Fifth " " ...	=	1·3	"	"
Total		17·9	"	"
Deduct for blank ...		3·0	"	"
		14·9, equal to ·149 parts per 100,000.		

No. 3 Estimation.

250 cc. sample taken, and 1 litre distilled water.

First 50 cc. distillate ...	=	7·1	cc.	weak solution.
Second " " ...	=	6·9	"	"
Third " " ...	=	5·0	"	"
Fourth " " ...	=	3·7	"	"
Fifth " " ...	=	2·7	"	"
Total		25·4	"	"
Deduct for blank ...		3·0	"	"
		22·4, equal to ·089 parts per 100,000.		

It is possible that if when the amount of sample was

increased the alkaline permanganate had been also increased proportionately, the results would have been more nearly alike; but that, of course, does not affect the question so far as the point to which I wish to draw attention is concerned—viz., the necessity for some official or, at any rate common, method of procedure.

It is not my intention to presume either to formulate a standard of pollution, nor to suggest the particular methods of analysis to be adopted.

I hope I have, however, succeeded in drawing attention to the necessity for both, and now that a Rivers Pollution Conference has been added to these gatherings, I hope that before long a committee will be appointed out of that section to report after due deliberation on the subject from all points of view.

[*This discussion applies also to the paper by* Mr. F. T. Poulson.]

Dr. J. T. Wilson, County Medical Officer (Lanark), called attention to the important change made in the administration of the Rivers Pollution Prevention Act, 1876, by constituting County Councils Local Authorities under the Act. The chief reason why the Act of 1876 remained so long a dead letter was because those to whom the execution of its provisions was entrusted were themselves the chief offenders. Now the County Councils cannot be offenders, and therefore they are free to carry out the powers of the Act without fear.

Dr. G. Reid (Staffordshire County Council) said it would be a fatal mistake to attempt to arrive at a standard of purity for sewage effluents. A satisfactory uniform standard could not be fixed as many circumstances had to be taken into account in judging of the capabilities in each district as regards sewage disposal. For example, in Midland districts, situated on small streams, it is of the utmost importance that the highest possible purity should be insisted upon, whereas, in the case of towns more favourably situated on large rivers, the standard might possibly be less exacting. What we want is that authorities should do all that can reasonably be expected of them, having regard to local conditions. The standard hinted at by Mr. Naylor could not be accepted in the case of Midland districts where—as is frequently the case in Staffordshire—the volume of sewage effluents is greater than the streams into which they discharge. As regards trade effluents, it might be possible to arrive at a standard in special cases, and if this could be done it would no doubt be of great service.

Professor A. BOSTOCK HILL (Birmingham) wished to accentuate the difficulty of attempting to fix a standard for sewage effluents, and quoted a case where a tank effluent, without any preliminary treatment, gave better results than the Rivers Pollution Commission standard and yet subsequently so seriously polluted a stream that an injunction was applied for and obtained. In individual trades a standard may be arrived at.

Mr. FRANK SCUDDER (Manchester) stated that Sir Henry Roscoe advised the Mersey and Irwell Joint Committee that it was undesirable to define the maximum amount of pollution to be allowed in an effluent. At a later period however as a help to the Committee he gave them figures with a view of comparing the results from the various sewage works within the watershed. The Joint Committee had not adopted a standard but used these figures for the purpose of helping them to judge of effluents. Mr. Naylor appeared to be in favour of adopting the Rivers Pollution Commissioners' standard, but to that he objected for two reasons. The first was on account of the intricate manipulation and the inherent defects of the Frankland-Armstrong process for the estimation of the carbon and nitrogen, and secondly, if they knew the absolute amount of nitrogen and of carbon in the effluent, it was of very little value in guiding them to a judgment as to whether the effluent was going to cause any trouble when discharged. It was essential that they should not have a definite standard fixed, but regard should be had to methods of analysis which differentiated matter which was harmful in an effluent from that which was harmless. He took exception to the remarks by Mr. Naylor with regard to the permanganate test, and explained in detail and by means of diagrams the excellent results of that test in his own experience.

Mr. SIDNEY R. LOWCOCK (Birmingham), pointed out that if a standard for manufacturers' effluents were instituted it ought to be the same over the whole country, as then the necessary treatment of waste would be equally incumbent on all manufacturers and would form part of the ordinary working expenses; if not the tendency would be for manufacturers whose works were situated on the upper waters of a stream to move their works lower down where the standard was less exacting, and thus lower the rateable value of the towns higher up the stream. The same difficulties would apply in a somewhat less degree to the imposition of varying standards of purity for sewage works' effluents, as the smaller towns on the upper part of the stream, which are less able to afford it, would have to produce a better effluent than the larger towns lower down which have greater means at their disposal. He also stated that from his experience the oxygen absorbed test, gives far more reliable indications of what the effect of any effluent on the river into which it is discharged is likely to be than the albumenoid ammonia test.

Alderman J. F. SPENCE (Chairman Tyne Port Sanitary Authority) said

between Tynemouth and Newcastle-on-Tyne, a distance of ten miles by the river, there is as large a number of works discharging foul and poisonous effluents as probably on any other stream in the kingdom. But these are so largely diluted by the enormous influx of sea water twice in the twenty-four hours, the difference in time between high water at the bar and Newcastle Quay being only seventeen minutes, that the late Mr. Frank Buckland, when Inspector of salmon fisheries, quoted the Tyne as one of the best salmon rivers in the kingdom, the pollutions being so diluted that the fish passed there unscathed to their spawning grounds in the higher reaches of the river. It may therefore be said the pollutions cause no nuisance, as the tide clears them all away.

Mr. HERBERT NIELD (Middlesex County Council), referring to the condition of the river Brent said that it was not always practicable to follow the advice of a previous speaker and wait until a river "turned sick," because in the case of the Brent the quantity of weeds and vegetable growth tended to retain the subject of pollution, and consequently such a stream would become foul long before there was any observable sign in the water itself. On the question which had been debated, viz., the fixing of a standard of purity, he agreed that it was one of great difficulty. Clearly a standard which would satisfy the case of a river with but even a sluggish tide, would not be satisfactory in the case of a shallow winding and much obstructed stream such as the Brent, besides which much of what had been said was in connection with pollution by trade refuse which was not the source of trouble with the Brent—that must be sought rather in the impure sewage effluents or storm overflows from sewage farms and works. The difficulty that the Middlesex County Council laboured under was want of legislation on the subject and the Council's inability to directly promote a Bill in Parliament to deal with the various authorities through whose districts the Brent flows. He agreed that it was most desirable to strengthen the Rivers Pollution Act 1876 by further legislation.

Letter received from Sir FRANCIS SHARP POWELL, Bart., M.P. (Vice-President):—

ISCHL, AUSTRIA.

Sept. 7th, 1897.

. . . . As the time of our Autumn Congress approaches I must not delay a line of apology and regret for my absence from the meeting

in Leeds. I should most gladly have attended had attendance been possible.

I learn from you that the subject of Prevention of Rivers Pollution will probably be discussed. Having been in charge of the Rivers Pollution Bill during some years at the request of the County Council's Association, and with the valuable aid of Dr. Farquharson, I venture to write a few lines.

Public opinion in favour of our Bill is fast growing, and I have good reason to hope that much of the opposition will disappear. I have, I need not say, pressed the matter on the attention of successive Governments. In the present temper of the House of Commons as regards Bills introduced by private members, the Rivers Pollution Prevention Bill cannot be passed by a private member, but much may be effected by pressing forward the measure, doing all that can be done to mature public opinion and urging the Government to take the matter up and pass the Bill, or a Bill like unto it, themselves at an early date.

Meanwhile we have the experience afforded by the administration of the Mersey and the West Riding Acts. Much is being done under both Acts.

The authorities are proceeding with much discretion, and avoid unnecessary irritation in the execution of a difficult duty.

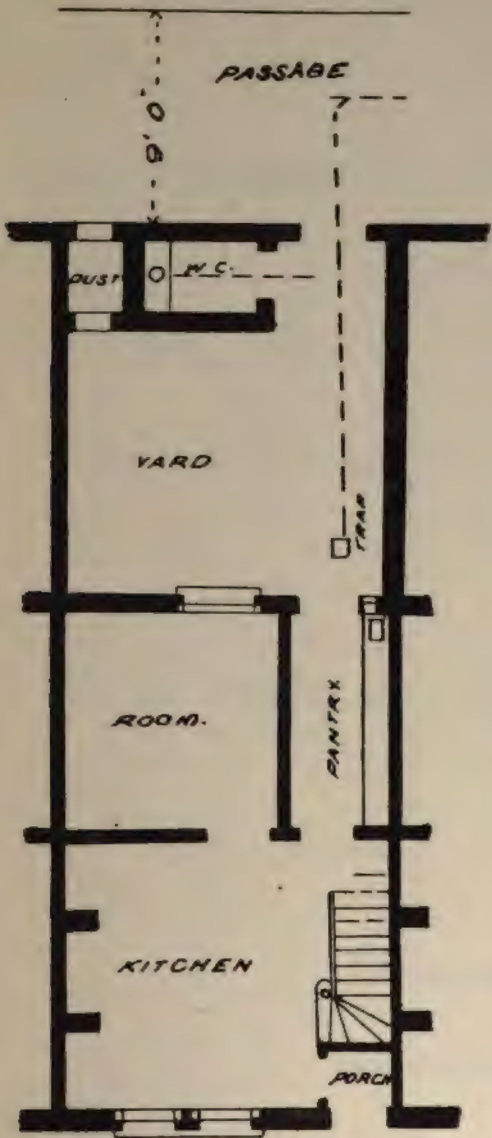
The successful operation of the statutes in such counties as Lancashire and Cheshire, the seats of our largest industrial establishments, is surely a great encouragement and justification for moving in advance by every means at our command.

We shall greatly value any action in favour of our Bill which may be taken by the Congress at Leeds.

The only other point to which I should venture to refer in these lines of apology is that of Vaccination. I am very hopeful that the Government may at length see their way to legislate. A new report issued since Parliament rose, on Calf lymph, may clear away difficulties.

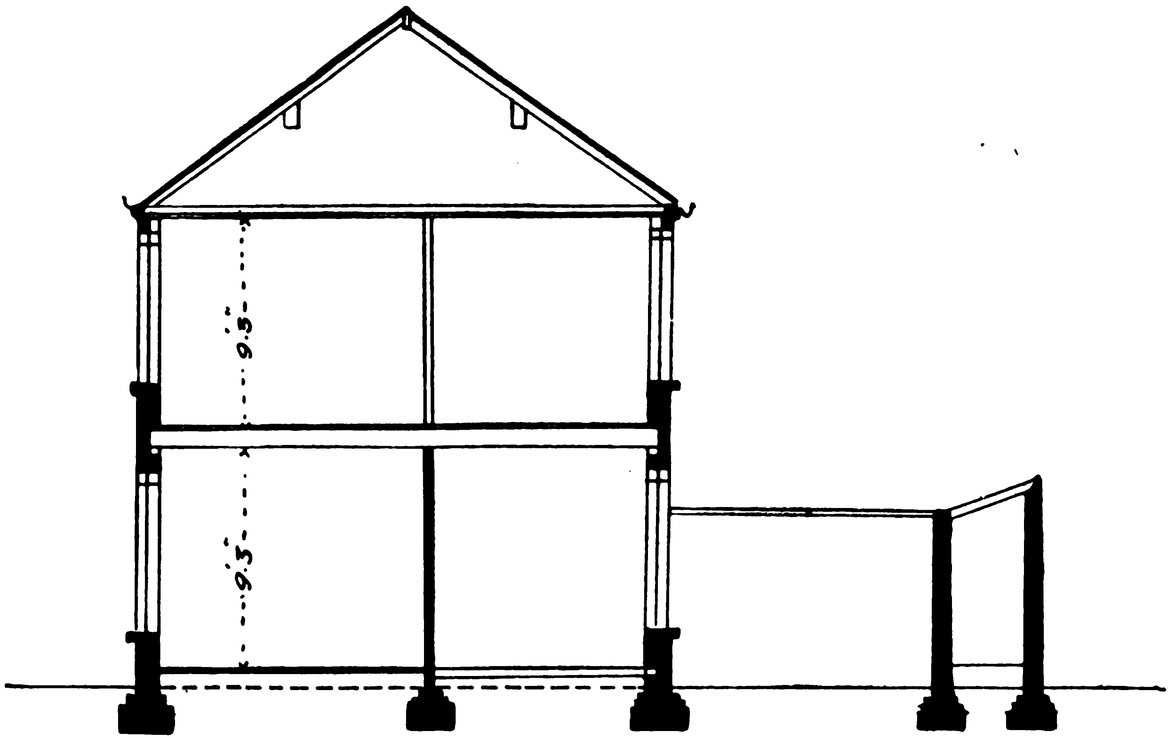
The President was so good as to promise me the immediate publication of the Report, which is probably already known to many members of the Congress, or will at any rate be so known at an early date . . . .

A.



GROUND PLAN

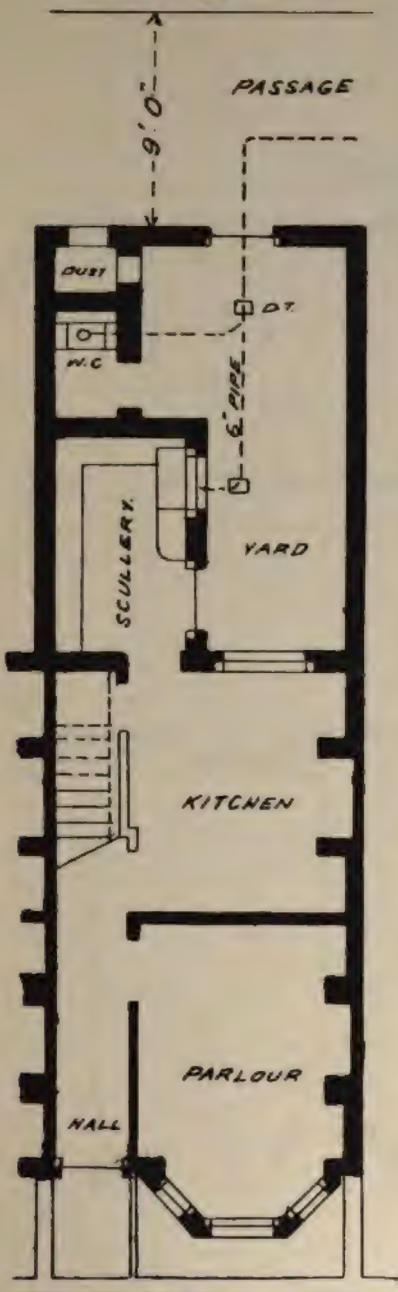
Scale—8 feet to one inch.



SECTION

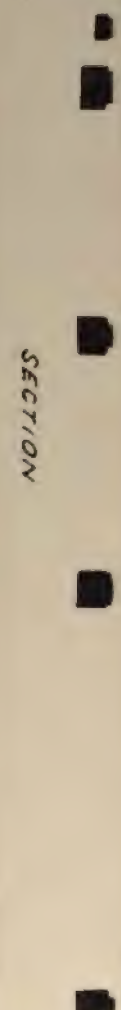
Scale—8 feet to one inch.

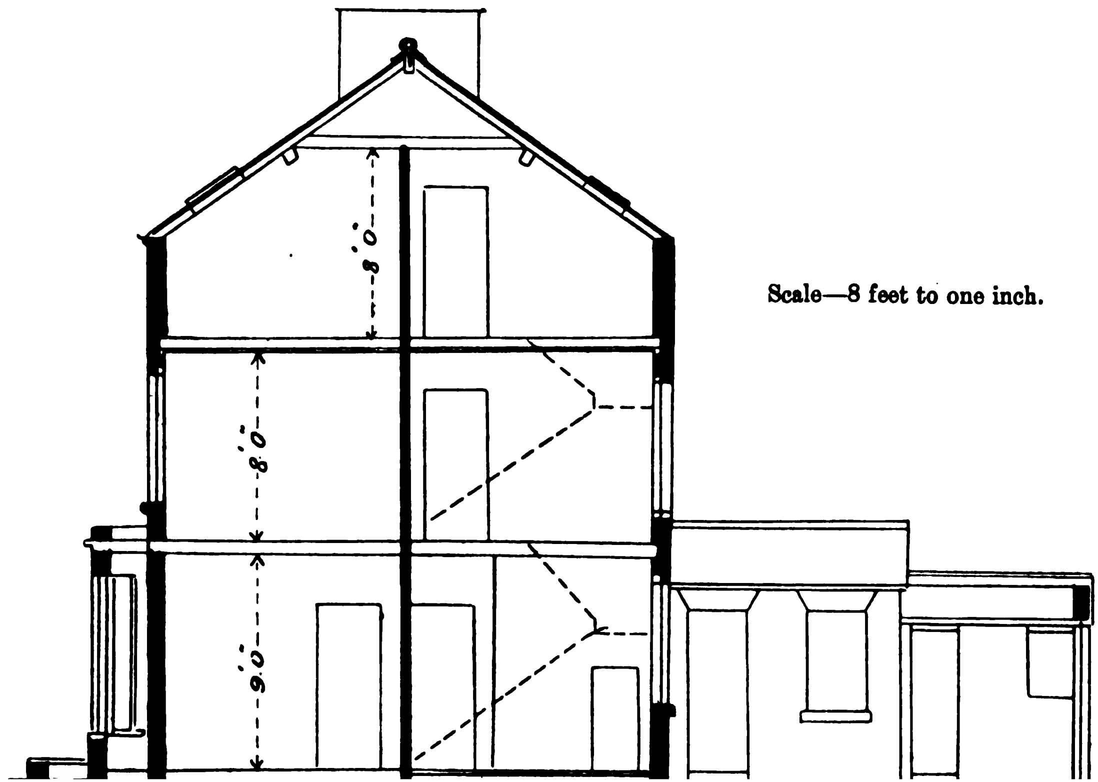
B.



GROUND PLAN

Scale—8 feet to one inch.





Scale—8 feet to one inch.

CONGRESS AT LEEDS.

CONFERENCE OF MUNICIPAL REPRESENTATIVES.

The proceedings of the Conference commenced with an address by the President, Councillor WOMERSLEY, published in the Journal, Part III., Vol. XVIII.

"*Workmen's Dwellings in Belfast*," *by* JAMES MUNCE, Assoc.M.Inst.C.E.

(MEMBER.)

IT has been stated that the Belfast workman is provided with the cheapest dwelling in the United Kingdom. Whether this is so or not the author does not pretend to say, but knowing that one of the aims of The Sanitary Institute is to encourage the construction of improved dwellings for the working classes, it is thought a few notes on the dwellings of Belfast may be of interest, as this meeting is held in one of the leading centres of industry where the working man is everywhere in evidence.

In the year 1845 the Corporation obtained "an Act for the Improvement of the Borough of Belfast," under which many old lanes and courts were cleared away, and about two miles of streets, 70 and 80 ft. wide, constructed. The buildings erected in these new streets are chiefly warehouses and offices. This Act condemned cellar dwellings unless provided with a window and fire-place, and prevented the construction of new cellar or other dwellings, unless as above, and also with a yard not less than 10 feet in depth from the rear of wall of such dwelling, the levels of the floor to be raised to a height to permit proper drainage, and in case of new houses to be at least 6 inches above the footway. Heights of ceilings were fixed at a minimum of 8 ft., except in the uppermost storey where they may be 7 ft. 6 in. No dwellings to be erected in courts less than 20 ft. in width, except with the special consent of the Corporation. Many other provisions contained in it are of great use to-day, and have not been excelled by the most recent legislation.

At that time the population of Belfast was about 78,000, and the staple trade, linen manufacture. An unfortunate chancery suit arose out of the purchase of a large area of property whereon the markets, etc., are now placed, and interfered with the progress of the town for some years: this was settled by an indemnity Act in 1864, and trade began to revive about the

same time, causing such a demand for dwelling houses (the population having increased to about 148,000) that the Corporation obtained an Act in 1865 separating the town from the county for certain purposes, notably street repairs, &c., providing proper control for laying out new streets, &c., making it penal to commence a new street or house without first having the plans thereof approved by the surveyor.

One omission in this Act was provision for back streets or lanes as means of access to the rear of houses. It fixed the minimum width of a new street at 30-feet, and gave the Corporation power to require them of any width up to 70 feet. Many miles of streets were laid out 30 and 35 feet wide respectively, the land devoted to the buildings being only 30 feet deep. Of this space at least 10 feet were allocated to the yards, and the remainder to the houses: the kind of house erected in such streets, consisted of a kitchen on the ground floor with a scullery under the stair and two rooms above. A privy and open ash-pit in the yard. The smallest of these houses had 11 feet frontage, and was 18 feet deep. These houses, however, were found so small, that very soon an additional foot of frontage was given, and the scullery was enlarged. Gradually the size increased, and wider streets were asked for in some cases, so that an owner in laying out his property had to make some streets 35 and 40 feet wide, and in the better class districts, or where traffic was likely to increase, even wider than this.

In 1878 an Act amending the previous Act was obtained. It gave power to insist on cross streets being laid out not more than 200 yards apart; on back passages not exceeding 9 feet in width to all new streets; and dealt with the ventilation and sanitary matters up to date. At once its effects were seen. The land devoted to houses became greater in depth, areas began to be left in front so that houses were not close to the street, and streets of 30 feet in width had from 40 to 45 and even 50 feet between the buildings. The Water Commissioners having a better supply of water, w.c.'s became the rule, and privies the exception, until now a privy is not even proposed.

The Public Health Department is gradually but surely getting all privies converted into w.c.'s, and where privies are allowed to remain for the present they are reconstructed on the latest ideas, with ash-pits so arranged that the excreta is covered by the deposit of ashes or other dust.

Building land is either leased for ever at a rental per annum, or for very long terms such as 1,000, 10,000, or more years. The rent of land varied from £20 per acre upwards, but now £40 is a low price. The usual course is for an owner to take

a lease from the head landlord of a number of fields, at a rent per acre, lay out the area in streets, and having either wholly or partially made them, let off the frontages at a price per foot per annum. The usual price now with streets made is from 3s. per linear foot upwards according to the width of street. The lessor takes all responsibility for the streets, undertaking to make and maintain them until they are adopted by the Corporation, which is done as a matter of course when they have been completed to the satisfaction of the surveyor and maintained in good order for twelve months. In this way the ground rent of a 12 ft. house is from 36s. per annum upwards, and so on according to the frontage and rate per foot.

The diagrams facing page 40 show the accommodation provided in various classes of house, the approximate cost, and rental charged per week. It is usual to collect the workers' house rents weekly. Competition has been so very keen that the houses are now fitted with blinds, gas fittings, &c., and many with baths, and indeed every inducement is offered to incoming tenants. In September last a plan for houses has been approved in which it is proposed to provide hot water to the scullery of small houses.

Owing to the increase of population the demand seems not to wane, and almost 1,500 such houses are built each year.

The other day forty acres of land were taken by one firm to develop in this way. The Tramway Company are pushing their lines out to the country in all directions, and the buildings are following owing to the cheap fares and ready access to places of employment.

The class of houses erected is suitable to the workers who are compelled to live in the neighbourhood, and one can easily tell by the houses whether the occupants are engaged in shipbuilding or linen manufacture with its various branches, or other industry. One feature in Belfast is that almost every family occupies one house, the census of 1891 gives the following table:—

42,240	houses	occupied by	one family each.
3,745	do.	do.	two families each.
275	do.	do.	three families each.
86	do.	do.	four families each.
16	do.	do.	five families each.
9	do.	do.	six families each.
2	do.	do.	seven families each.
1	Barrack occupied by sixteen families.		
1	Workhouse occupied by eighty families.		
1	Military Barrack occupied by one hundred and thirteen families.		

The number of persons owning their own house is increasing year by year: a very general custom being to pay £15 or more at once, and so much per month for ten years, the monthly subscription being just a little in excess of the usual rent.

The density of population in the newer portions of the City may be taken as fifty houses per acre. This result has been obtained by actual measurement, and as the population is 4·8 per house, gives a ratio of 240 persons per acre.

In the case of filled sites the whole area of the buildings and yards is covered with Portland cement concrete 6 inches in thickness, but no such site is permitted to be built on until the Medical Superintendent Officer of Health first approves of it as suitable. Recently owners have made agreements with the Corporation that they will not seek to build until the lapse of seven years from the completion of the filling.

The houses are built of good bricks and mortar, the outer walls 9 ins. thick, the party walls 4½ ins. with chimney breasts; joists, 9 ins. by 1½ ins. spruce; 1 in. redwood flooring; spruce rafters, 4½ ins. by 1½ ins.; purlins, 7 ins. by 3 ins. covered with slates. The joinery is of yellow pine. The exterior is faced, as a rule, with red perforated bricks, but in a few cases cement on common bricks is used. Party walls are carried up to slates, but not through except in cases of shops adjoining dwellings.

The floors of kitchen, yard, &c., are tiled, but in cases where concrete is insisted on over yard it is usually finished to form the yard surface. All drains are laid falling to the passage in rear. A house over a drain will not be approved, except where it is impossible to drain it otherwise, and in such cases the drain must be made of heavy cast iron water pipe, completely surrounded with concrete. The houses have few architectural pretentions, but are neat and comfortable.

The streets have footways flagged with 2 in. Kilrush or Caithness flags, or 2 in. artificial flags, laid on a bed of lime mortar, granite curbs, granite set channels one yard wide, and macadam centres on 9 ins. of blue stone pitching. In some cases trees have been planted, but streets must be 40 ft. wide for this with 11 ft. footways, and wide areas or gardens in front of houses. Gulleys are placed 30 yards apart in each channel. Paved crossings of granite blocks and sets are provided at street ends and gateways. The back streets and passages, if wide enough for carts, are paved with pebbles on 9 inch pitching; passages too narrow for carts are flagged like footways. Lamps are provided and fixed by the Corporation, and are placed about 50 yards apart on each side of street alternately. The streets

are scavenged, watered, &c., by the Corporation, and patrolled by the Royal Irish Constabulary. The Public Health Department inspects each house regularly, and also cleans the ash-pits frequently.

Working men's houses in Belfast are popularly described in two classes, *i.e.*, kitchen houses and parlour houses; each of these has various grades, and the rents vary from 2s. 6d. to 3s. 9d. for kitchen houses, and from 3s. 6d. to 6s. for parlour houses. The accommodation provided is shown in the diagrams facing p. 40.

Kitchen houses, as will be seen from diagram A, have a kitchen in front, with a small room behind, looking into the yard, which is sometimes used as a bedroom and sometimes as a sitting-room, and two bedrooms upstairs. In the more recent houses the window of the kitchen projects like a bay, adding to the area and cheerfulness of the kitchen. Some owners omit the room, and give the whole ground floor as a living room with a window in front and rear. The floor is of tiles, and the walls plastered for 3 ft. in height with Portland cement. There are cupboards on each side of the fire-place, and useful shelving all round. The room behind has a wooden floor with plaster walls finished grey. Sometimes a fireplace is put in this room, but not often. The front bedroom upstairs has a fireplace, and every room not so provided has a ventilator opening to the outer air. All windows are hung to open. A scullery is provided beside the small room, and fitted with sink, shelving, &c.

The yard is tiled or concreted: plain W.C. apparatus, with 3 gallon flushing cistern is fixed at the rear of the yard in a building which also contains a covered and ventilated dust-bin, the walls of which are plastered with Portland cement, and the floor formed of cement concrete 3 in. above the level of the yard, with openings to permit moisture draining out on the yard surface. A drain from the W.C. joins the main drain in the back passage. A yard gully connected to the sewer in the passage at the rear carries off surface water. These ash-pits are cleansed by the Public Health Department from the lane, without entering the yard.

In cases like the foregoing, a ventilator with grate at level of surface is placed at the upper end of the sewer in passage; and a disconnecting trap is placed before its junction with the street sewer, and inspection chambers are fixed every 60 ft., and position marked on wall.

In the case of long lanes, intermediate ventilators are constructed. The drain in the passage is 9 in. in diameter at least, laid with a fall of not less than 1 in 100, while the house drains

are laid with a fall of not less than 1 in 60. For some years the house drains have been jointed in Portland cement, while the main drains are jointed in puddle clay in the manner recommended by Mr. Rounthwaite in his paper read at the Newcastle Congress.

The drains of all houses with internal w.c.'s are tested by water or smoke before approval. In other cases they are tested if the Inspector has cause to doubt the care taken in laying them.

The water supply being constant is brought direct from the main into the scullery, with a branch leading to the w.c., the only cistern being the flushing cistern in the w.c.

Gas is laid on to each house, and one light provided in each room.

Parlour houses are shown in diagram B facing p. 40, and are fitted up rather better than kitchen houses, and with the exception of the sizes of the rooms and heights of the ceilings are much on the same plan as houses letting up to £50 a year. These houses are sometimes made two-and-a-half storeys in height, and have in most cases a little area from 5 ft. upwards in front of the house, enclosed with iron railings; the smaller areas being laid with concrete, and the larger either with coloured gravel, or cultivated as flower gardens. These houses are now in the majority of cases fitted with a small bath, which is a great luxury to the cleanly working man. They have tiled hearths, and marble or enamelled slate mantel pieces.

To sum up, working men's dwellings in Belfast are rented as follows:—A house containing three rooms, total 5,000 cubic feet, yard of not less than 100 square feet open space, supplied with water, blinds, and gas fittings, is obtained for 3s. 9d. per week free of all rates and taxes; one containing 6,000 cubic feet for 5s.; and one of 7,500 cubic feet for 6s.

It should be stated that the rates in Belfast are collected by three authorities: Poor's rate by the Board of Guardians, Water rate by the Belfast City and District Water Commissioners, Municipal rates by the Corporation. In the case of the latter the rates on houses of £8 valuation* and under are payable by the landlords, to whom a discount of 25 per cent. is given if the rates are paid within one month of being struck. This has the effect of bringing in a large amount of money in the early part of the year.

Some years ago houses of 15 feet frontage were built in a street 40 feet wide, and set back 10 feet, the total depth of site being 55 feet. They were provided with bath, hot and cold water, internal w.c., &c., 35s. per month, free of all rates except

* All Rates in Ireland are assessed on the Government Valuation.

water, was readily given, and they have never been unoccupied. These houses contain on the ground floor, parlour with bay window, kitchen, scullery, and pantry; on upper floors, drawing-room and bed-room, with two attics and dormer windows.

It may be interesting to say that the Local Government Board have not required the Corporation to erect any houses instead of those removed under the Artizans' Dwellings Act or the Housing of the Working Classes Act. In one case under the former Act the Corporation took a site about two-thirds of a mile distant from the condemned area, at a rental of £50 16s. 3d. per annum, and having laid out streets thereon leased the land with a covenant to build houses similar to a plan prepared by the Surveyor, and approved by the Local Government Board. This land was all taken up at a rental of £128 10s. per annum, and the houses were erected in a very short time. The head rent of £128 10s., subject to £50 16s. 3d., or a net profit rent of £79 13s. 9d., was afterwards sold by the Corporation, and brought twenty years' purchase, the actual amount being £1,550.

In a scheme under the latter Act the Corporation were not asked to provide houses for all those displaced, as it was shown at the Local Government Board enquiry that ample house accommodation was obtainable within a mile of the site, but they were required to provide sites for 35 houses. These have all been let by the Corporation, and the lessees have erected houses in accordance with a plan prepared by the Corporation and approved by the Local Government Board. They are let at rents of 5s. per week on the average.

Owing to its situation there are exceptional facilities for the cheap purchase of materials in Belfast, as shewn by the accompanying table:—

1. Bricks, 30s. per M., delivered.
2. London Portland cement, 32s. per ton.
3. Lime (local), 13s. 6d. per ton.
4. Sand, 1s. 6d. to 3s. per ton.
5. Spruce, 12 in. by 9 in. by 3 in., 2s. each.
6. Redwood flooring, 7s. for $\frac{3}{4}$ in., 9s. for 1 in. per square.
7. Yellow pine, 2s. to 2s. 3d. per cube foot.
8. Slates, 125s. per ton (formerly much less).

   (*a*) Labourers, 16s. 6d. to 17s. 6d. per week.
   (*b*) Bricklayers, 8½d. per hour.
   (*c*) Carpenters, 8½d. per hour.
   (*d*) Plasterers, 8½d. per hour.

The above are trade society wages, but many employers pay higher wages to the best men.

"*On the Influence of the Example of Large Towns in relation to the Sanitation of their smaller neighbours,*" *by* T. PITNEY ASTIN, L.S.A.

NOTE.

THE author endeavoured to draw the attention of the larger cities and towns to their responsibilities as to sanitary progress in their neighbouring areas governed by smaller representative authorities. Just as no man liveth to himself, so no town is absolutely self-contained in the matter of sanitary progress, and our larger sanitary authorities determine, to an extent they little think of, whether the small Urban District Councils shall be up to date or not.

"*Drain Testing: Some facts revealed by testing the drains of* 1,121 *houses in which Typhoid and Diphtheritic Disease was thought to be present,*" *by* J. SPOTTISWOODE CAMERON, M.D., B.Sc., &c., Medical Officer of Health, Leeds.

IT has been our habit for many years in Leeds that the Ward Inspector shall make a special examination of any house in which disease of a zymotic character is known to have been present. The conditions revealed by such examination are from time to time classified by the Medical Officer of Health, according to locality and nature of disease and laid before the Sanitary authority. The large amount of material thus being collected is year by year becoming increasingly valuable, not only as showing the prevalence of diseases of a certain character in a certain class of house, but also because when combined they reveal to some extent the class of house defect most common in the several districts into which the town is for sanitary purposes divided. Valuable as this large and growing material has become, its value has been, until recently, less than it might otherwise have been, owing (1) to the possible unintentional selection of those houses occupied by the poorer inhabitants of the city, and (2) to the incompleteness of the methods of examination employed.

The first of these drawbacks is due to our imperfect acquaintance with the localities in which these diseases exist. To some extent (at least in regard to certain of these maladies) this diffi-

culty has been lessened by our recent adoption of the Notification Act of 1889. The incompleteness of our examination is chiefly due to the large amount of other work to be done by the staff; to put it in another way,—to the inadequacy of their number for accomplishing a complete and satisfactory examination of the town. The day has, it seems to many of us, gone by when the duties of a ward inspector should be limited to the verification of nuisances discovered and complained of by the householder. If the sanitary is to become an efficient preventive service, we must evidently examine the houses in our districts before, and not merely after, they have given rise to disease.

This second difficulty, the imperfection of our examination, has come about from want of the necessary time for the complete testing of the drains of every house examined. We have, heretofore, been apt to content ourselves with the ordinary ocular and, if necessary, manual examination of the appliances and with ascertaining that they appear to be in good working order, reserving the application of drain tests for such houses as manifest some more or less visible defect or where the persistence of infective disease has suggested their desirability.

Since an early date in 1894 we have made it our practice to supplement the ordinary examination of the house by testing the drains in every case of typhoid, diphtheria, and membranous croup, reported to us; requiring a written report on a special form of the result. All houses in which a death from "croup," of any not merely neurotic kind, was reported were similarly dealt with. So that from the early part of 1894 to the end of 1896 we have specially tested 1121 houses in which typhoid or diphtheritic disease is supposed to have occurred. The test we usually apply is the smell test. A small grenade containing calcium phosphide is exploded beyond the trap. The odour of the volatile hydrogen phosphide formed in the drain or sewer is exceedingly penetrating.*

Taking the two classes of disease together we find that, of the 1121 houses thus examined, no fewer than 30 per cent (30·5) allowed the smell of the test placed in the drain, or sewer, to enter the dwelling. Precautions were of course adopted to prevent any error from our mistaking the smell carried from the sewer ventilators for the smell entering directly from defective drain pipes.

When nearly a third of the houses examined are thus found in aërial connection with the sewer, it will at once be asked: "What proportion of these were properly "cut off" from the drains?" Omitting for the moment the disconnection of the

* Dr. Cameron exhibited two different forms of apparatus for applying the test. Their extreme portability and the simplicity of their action was explained.

soil pipe of an inside water closet, it may be stated roundly that nearly half the 1121 examined houses were severed from the house drain or sewer in regard to every other waste pipe from basement to attic. The exact number was 529 or 47·2 per cent. The remaining 52·8 per cent. had one or more wastes going either, in a very few cases however, directly into the drain or merely protected by a trap of some kind.

This slightly larger class of "undisconnected houses" includes many in which all drains above ground were cut off *secundum artem*, but where the basement drain joined the sewer after passing its contents through a "box trap," a favourite device with our immediate predecessors. Let us separately consider the result obtained in these two classes of houses, the "disconnected" and the "not disconnected"—the "severed" and the "not severed." In doing so we shall, in the first instance, disregard the treatment of the soil pipe where an inside water-closet obtained.

Houses with Drains Severed.—The number in this class as just said was 529. Of these 16·3 per cent. showed drain defects capable of admitting drain or sewer gas to the dwelling. In 83·7 per cent. no such defects was revealed by our test. In other words, of every 100 houses "severed" from the drain or sewer in 16¼ there was still aërial connection between the dwelling and the drains.

In the other, or *non-severed* class, the results as might be expected were still less satisfactory. In every hundred houses of this class 43·2 allowed drain gas to enter the house direct, while the test findings were negative in 54·8. This startling result is probably more than a co-incidence as the examination was of nearly 600 houses.

In these broad figures there is not much room for error. One speaks less confidently in dealing with certain groupings of these houses, especially in relation to the presence of water closets within the dwelling. But the subject is so important, as affecting the large and increasing class living in houses with conveniences of this kind that the figures are given for what they are worth.

Of the 1,121 houses examined on account of typhoid or diphtheritic disease, 127 had one or more water-closets built within, or partly within, or entered from within the house. Of this small number, 49 per cent. yielded positive signs of drain defect on testing. As to the remaining 52 per cent., the evidence was negative. While, therefore, less than a third (30·5 per cent.) of the houses tested in the whole group, irrespective of drain disconnections or the existence of an inside water-closet, showed defects, defects appeared in nearly half (48·8 per cent.) when only those with inside closets were considered.

These 127 inside-closet houses, deducted from the whole number examined, leave 994 whose conveniences are outside the dwelling. Of these, irrespective of drain disconnection, twenty-eight in every hundred showed defect, as against 49 where an inside w.c. existed. So far as these figures go the advantage in safety from sewer gas was greatly in favour of the house with the convenience outside. And these latter (in this respect healthier) dwellings are the dwellings of the poorer class not of the better class.

The question of severed and not severed drains should not be ignored in these houses with inside w.c.'s, although, as we subdivide, the figures become less trustworthy from their smallness. Where, in the entire group of 1,121, the house had every other drain than that of the inside w.c. severed, the proportion of 30·5 per cent of faulty houses fell as we saw to 16·3. It was 11·5 in houses without, 40·2 in those with an inside water-closet. Where the houses were not severed the 30·5 per cent. rose to 43·2 in the whole group, being 45·5 in those without, and 67·5 in those with inside w.c's.

Summary.

So far as these figures go, it would appear that :—

1. Nearly one third of the 1,121 houses were in aërial communication with their drains.

2. This fault was more than twice as common where disconnection of wastes had not been carried out; namely, as 43 in the non-severed to 16 in those "cut off."

3. Neglecting disconnection, a water-closet *inside the dwelling* increased by four-sevenths the chances of the entrance of drain air, raising the faulty proportion from 28 to 49 per cent.

4. Where severance of other wastes was effected, the risk of direct aërial connection with the sewer increased from 12 per cent. in houses with closets *outside* the dwelling to 40 per cent. where they were *inside.*

5. Where, on the other hand, drain severance was incomplete, the risk was greater whatever kind of closet was in use, but rose from 41 per cent in those *without*, to 68 per cent. in those *with* an inside convenience.

The table appended to the paper gives the following results :—

Percentage of houses in aërial connection with their drains where :

Wastes were severed and closet outside ...	11·5
Wastes not severed, but closet outside ...	41·5
Wastes severed, but closet inside	40·2
Wastes not severed, closets inside	67·5

These figures may perhaps warrant some of the following

CONCLUSIONS.

1. As even in houses free from the special dangers due to the presence of a water closet within the dwelling, and further protected by the disconnection of all other waste pipes, drain testing revealed serious defects in nearly 12 per cent. of those tested, it is obvious that there should be a regular systematic and periodical testing of all house drains.

2. This periodical examination by tests should be three times as frequent where, though free from the special dangers attending the inside closet, the other waste pipes are not "cut off" outside the house.

3. It should also be three times as frequent where, though all other wastes are disconnected, there is a water closet within or beneath the dwelling.

4. It should be six times as frequent where there is the double danger of an inside water closet and of undisconnected house wastes.

TABLE *showing drain test findings in 1,121 houses in which typhoid or diphtheritic disease was supposed to have been present.*

	Houses.	Percentage.	
		Found Faulty.	Result Negative.
The whole group	**1121**	**30·51**	**69·49**
Wastes "severed"	529	16·26	83·74
Wastes not "severed"	592	43·24	56·76
Convenience outside	**994**	**28·17**	**71·83**
Wastes "severed"	442	11·54	88·46
Wastes not "severed"	552	41·49	58·51
Closet inside	**127**	**48·82**	**51·18**
Wastes "severed"	87	40·23	59·77
Wastes not "severed"	40	67·50	32·50

"Severed" means that every waste, other than the soil pipe, comes through an outer wall and discharges in the open air outside the house.

"*Ought Manure and Stable and Cowshed Litter to be Collected at Public or Private Expense?*" *A Question with a Note, by* JOHN F. J. SYKES, M.D., D.Sc., M.O.H. St. Pancras.

(FELLOW.)

THERE is no very great difficulty in obtaining the removal of manure during the major part of the year, but in London during July and August farmers and market gardeners do not want manure, in fact decline to receive it. There is therefore a difficulty in disposing of it, and this gives rise to successive troubles. During these two months there is another difficulty in the fact that market gardeners and farmers' carts—which at other periods of the year take the manure out of London—are so anxious to save time in bringing produce in, that they make the return journey immediately they have discharged their loads, and without calling for manure.

Another difficulty is that the railway companies are extremely busy during these two months, both with carrying market produce, and holiday makers, so that not only are they anxious to keep their lines clear of less remunerative traffic, but they cannot afford to allow trucks full of manure to remain idle in their country sidings because the farmers do not want it, and it can neither be sold nor otherwise got rid of. It is therefore perfectly clear that whether private individuals or public bodies collect the manure, the difficulty of getting rid of it when collected would remain the same.

This difficulty of disposal is the reason why the manure accumulates and then gives rise to nuisance. Nuisances so arising, Sanitary Authorities attempt to abate, by bringing pressure to bear upon the owners of the accumulated manure who are the occupiers of the stables and cowsheds. These occupiers find that they cannot obtain the removal of their manure during the months mentioned except at considerably increased cost; and under the pressure of Sanitary Authorities they turn round and endeavour to throw the onus upon these authorities of removing their manure at the public expense, that is to say, of shifting the burden and the cost from the private to the public purse.

Pursuing the matter further, it becomes a question of weighing the advantages and disadvantages sanitarily, executively, administratively, and, above all, pecuniarily, of removing manure and other stable and cowshed refuse by public bodies rather than by private individuals. Provided the removal is

supervised and controlled by public bodies through public officers, the first three points should be about equal in either case; the last, the question of cost, is the only one that makes a serious difference, and this resolves itself into a question of *whether it is or is not desirable that the whole community should pay for the removal of the manure and litter of those who keep horses, donkeys, or cows for trade purposes or for their private enjoyment.*

Dividing the refuse produced by the community into soiled waters, excreta, road sweepings, domestic refuse, manure, and trade refuse, the first four—which the whole community help to produce more or less equally—are collected and removed at public expense, and in the benefits of this the whole community share. But with regard to manure and trade refuse the whole community are not producers, and it is a question of policy for the whole community to express its opinion as to whether it will be willing to bear the burden and expense of removing the manure, and perhaps also the trade refuse, of those members of the community who produce them and derive profit or pleasure from their production.

The question is a very serious one on account of the huge expense, and it is necessary also to bear in mind that it must include the Omnibus Companies' stables, Job Masters' and Livery stables, Carriers' stables, Railway Companies' stables, and the mews and stables of many large firms and businesses. On the other hand, at the present moment public authorities remove at public expense horse droppings amongst the road sweepings, but this does not include stable litter.

The Medical Officer of Health of the County of London is now making an inquiry into the matter on behalf of his Council, but it would be of great utility to all those interested in this question to hear the opinions of this Congress.

"*Note on the Munich Slaughter-house and Cattle Market*" *by*

C. CHILDS, M.D. (Oxon.), D.P.H.

(MEMBER).

THE buildings of the Munich Slaughter-house and Cattle Market, commenced in March, 1876, were formally opened in August, 1878.

The site occupied by these buildings is practically well outside the city, at its south-western angle, in direct communication with the Southern Railway, and, through that railway, with the chief central station.

The buildings, with their enclosing wall (a little over 8-ft. high), cover about 25 acres; provision being made for future extension.

The Cattle Market is in direct contact with the Southern Railway Station, and is separated from the Slaughter-house by a road of about 32 yards width.

(*A*)—The Slaughter-house.

For the Slaughtering of different animals, six halls (*g*, *g*, *g*, *h*, *h*, and *j*) were provided in parallel lines, separated from one another by roadways about 50-ft. wide.

Three of these halls (*g*, *g*, *g*) are for the slaughter of large cattle. Each consists of two parts about 46-yds. long and 16-yds. broad, separated from one another by gangways about 20-ft. wide.

Each hall contains 80 slaughter places, and is fitted with appliances convenient for slaughtering, dressing, cleansing, flushing, &c. Air is freely admitted by numerous openings. Direct sunlight is excluded by jalousies made of upright iron plates, fixed outside the windows in such a way that they can be adjusted for this purpose according to the position of the sun.

The two halls (*h*, *h*) for slaughter of small cattle are similar in size and construction. That for swine (*j*) differs by being about 20-ft. wider, and has special appliances, on a large scale, for scalding and scraping the carcases.

Smaller buildings are provided—

(*k*) For the slaughter and examination of diseased animals, also for the slaughter of horses (in a separate hall).

(*l*) For the collection and removal of dung.

(*m*) For quarantine stalls.

(*n*) For skin and suet chambers.

(*o* & *p*) For the collection of blood.

(*q*) For the cleansing and scalding of stomachs, intestines, &c.

(*s*, *s*) For the stalling and preparation of animals which are about to be slaughtered.

(*t*, *u*, & *v*) For management and finance offices, with dwelling-rooms for some of the officials.

(*B*)—The Cattle Market

The Cattle Market occupies about eleven and a half acres, and provides for the stalling, feeding, and watering of the animals.

It consists of—

(a, a) Two large market halls for large animals.

(a^1, a^1) Two smaller halls, containing stalls for those large animals which are ready for slaughter.

(b) A large market hall for living swine and sheep.

(c) A large market hall for living calves, and for slaughtered calves and swine.

(d) A central weighing-house.

(e) A restaurant.

(f) Stabling and carriage-houses.

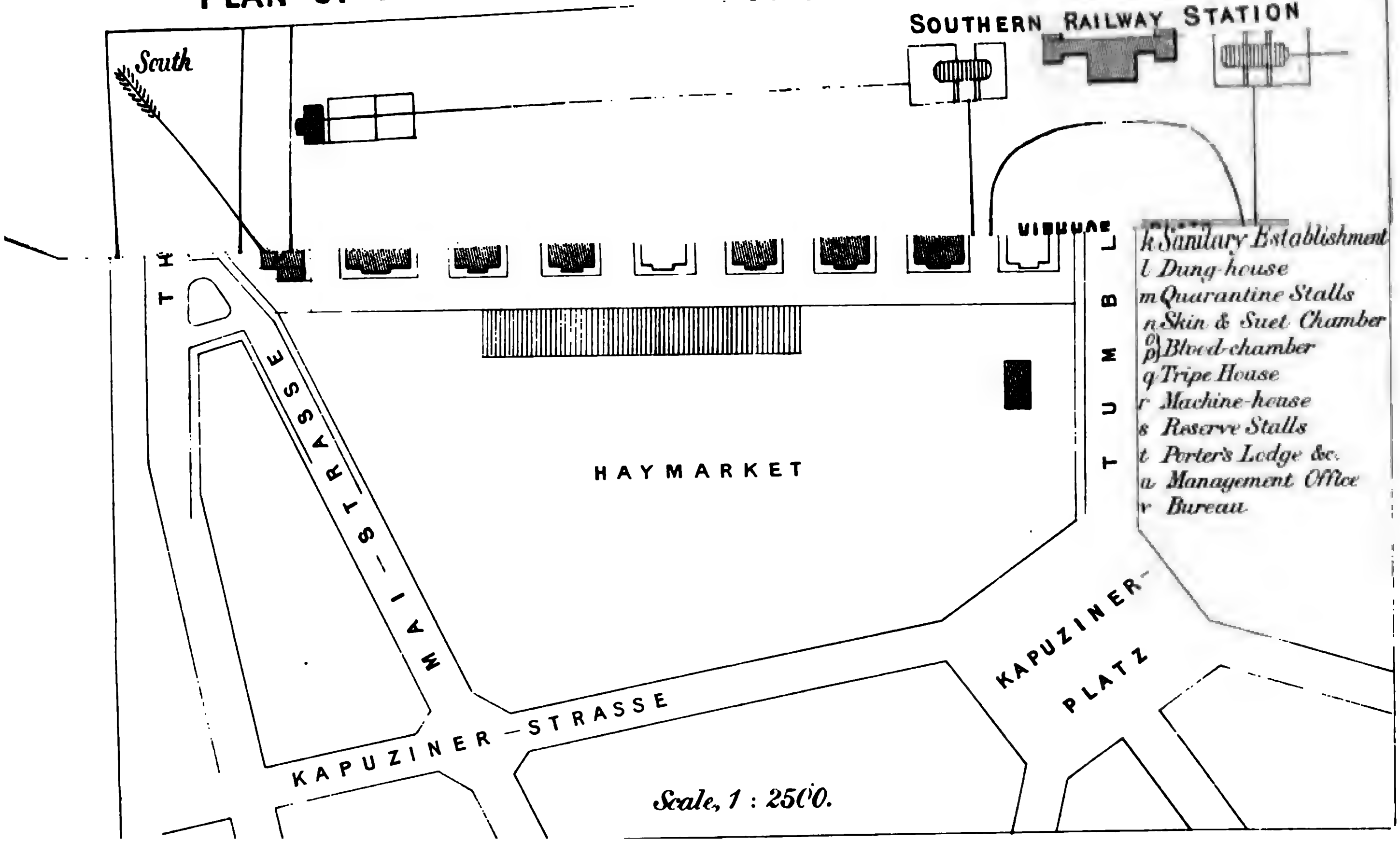
The population of Munich in 1878, when the Slaughter-house and Cattle Market were opened, was a little over 200,000; at present 1897 it is (like that of Leeds) about 400,000.

"*Rural Sanitary Administration*," *by* GODFREY CARTER, M.R.C.P.ED.

ABSTRACT.

THE author prefaced his remarks by drawing attention to the great benefit which had accrued, from the efficient working of the Public Health Acts, in our large cities and towns. The death-rates had steadily diminished, grave insanitary conditions had been rectified, and the medical officers, backed up by an efficient subordinate staff, were always available, and willing to investigate every case of zymotic disease, and take all available measures for safeguarding the public health. These officers were a body of gentlemen, specially qualified, both by intrinsic merit, professional attainments, and the possession of diplomas in public health, for the duties they were called upon to perform; and they were under an obligation to give their whole time and attention to the work. But elsewhere in the country things were different. All areas which were not included within the jurisdiction of the nearest urban authorities, were constituted into rural sanitary districts. These were presided over by the district councils, who appointed medical officers of health, and sanitary inspectors for their respective localities. In Public Health Acts many powers were left optional, to be exercised or not, at the discretion of the local governing bodies. Much more apathy existed in the rural councils, than in the

PLAN OF THE MUNICH SLAUGHTER HOUSE & CATTLE MARKET.



case of the urban ones on all that concerned hygiene. Therefore, the optional powers which parliament had granted to all, were allowed to lie dormant in country districts. A minimum of power was given to the Medical Officer. He was appointed by, and a servant of, the council, liable to have his recommendations negatived at any time, and (as in a recent case near here) liable also, to be threatened with dismissal, if he go counter to the views of his employers. For his services he is remunerated at the rate of from £15 to £30 a year, and is, therefore, of course, engaged in private practice.

The insanitary condition of country districts in general was then gone into in detail, and instances were given of whole villages where the sewage passed straight on to the land; where no powers were adopted by the health authorities to empty cesspools, clear ash-pits, or afford a proper supply of pure drinking water. Any request on behalf of an individual householder for attention was met by a direct "non possumus," and he was told either to do it himself or make his landlord abate the nuisance. The drinking water was often from private wells whose gathering ground was in close proximity, or actually beneath the soil upon which the sewage ran; and detailed chemical analyses were given of water now in use for such purposes, which revealed a composition of but slightly diluted sewage. These people were drinking this water 15 years ago, and they are drinking it now. The children in these districts do not thrive well, and suffer from sickness, diarrhœa, and enlarged tonsils. Instances were given and actually inspected by the author, where ash-pit refuse, in a state of offensive decomposition, was carted on to the bye-lanes by the poorer inhabitants, and left, owing to the statement they received, that there were no powers in that district for its removal by the authorities. No systematic inspections were made to investigate or find out nuisances, as is distinctly stipulated for in the Health Acts, and the water with which the dairy milk cans are washed was often grossly polluted, and the state of the farm premises in a neglected and unhealthy condition. It was impossible that solid advance could be made, except by a far-reaching reform in these matters. It is now well understood that consumption is not hereditary, it is always acquired, and a frequent source of infection is milk and the use of tuberculous meat.

It is thought that diphtheria and scarlet fever may be spread by the milk of infected cattle, yet no proper supervision over dairies or milch cows is carried out

The position of things in the small town of, say 5,000 to 10,000 inhabitants is but little better, and sanitary administration is not much more than a form, and the drawing

up of statistics. It is true that the institution of Medical Officers to the County Councils has been of incalculable service. They are highly specialised experts, who are giving their full time and ability to the public welfare. We hear of them everywhere, condemning a water supply here, a sewage effluent there, or devising means for the purification of our streams. But they cannot be ubiquitous, and they require skilled help to further their aims. I would suggest the active advocacy of the following recommendations.

1. The Institution of a Minister of Public Health.

2. That every Medical Officer of Health shall possess a special diploma, in addition to his medical degrees, and shall not be engaged in private practice.

3. That the present small and numerous rural sanitary districts be linked up into larger areas on the basis of our parliamentary electoral districts.

4. That each such area shall be administered by a medical officer who shall confine himself to such duties only. He should be responsible for the general sanitary administration of his district, for vaccination (which at present is grossly neglected by the Guardians), for drainage, for purity of water supply, and should have notified to him all cases of zymotic disease. The supervision of foods and analysis of milk, butter, &c., would naturally fall to the Sanitary Inspector and County Analyst.

5. That the Health Officers be appointed by the higher sanitary officials. To these only should they be responsible for the fulfilment of their duties.

The optional clauses in the Public Health Acts would thus be rendered of little effect, for the jurisdiction of local governing bodies would be abolished. The administration of laws in accordance with the dictates of the fundamental principles of health, is not a matter for the opinion of men, quite ignorant, by the absence of scientific education, of the elements of sanitary science. No Health Act yet passed comes up to the bare necessity of the situation, and to render its application optional is to insure its failure.

6. It should be illegal for any house to be let to a fresh tenant, or new house taken possession of, until the owner has received a fresh certificate from the District Medical Officer, certifying as to its sanitary condition, and its fitness for occupation.

CONGRESS AT LEEDS.

CONFERENCE OF MEDICAL OFFICERS OF HEALTH.

The proceedings of the Conference commenced with an address by the President, E. C. SEATON, M.D., F.R.C.P., F.C.S., published in the Journal, Part III., Vol. XVIII.

"*Poisoning by Canned Foods; Hints on its Prevention,*" *by* J. BROWN, M.D., Medical Officer of Health, Bacup.

From time to time the public is scared by reports in the daily papers of persons being poisoned by canned foods. Probably some of the reports are not true. Those largely interested in the trade believe that very few of these reports are true, and that a fatal case is very rare indeed, and when one has occurred it has been through gross carelessness in the person not using the senses of sight, taste and smell. The interests involved are so important, in regard to the extent of the business done and the enormous boon conferred to the working classes in having cheap foods and many fruits, which if home-grown would be luxuries for the rich only, that one should be most guarded in dealing with this question.

IMMENSE TRADE.

The canned food trade is an enormous one. Unfortunately the Board of Trade cannot furnish us with statistics. It has been stated that 581,000 lbs. of canned foods are consumed daily in this country; that tinned salmon is so popular that two million people eat it each day. One private firm in Liverpool has a turnover of over twenty million cans per year. The American Bureau of Statistics states that their exports of canned beef alone was 63,698,180 lbs. from June, 1895, to June 1896, and the following year was 54,019,722 lbs. In passing through the streets of our cities, towns and villages we see the windows literally decorated with canned goods. We are really living in what might be aptly termed the "Canned Food Age."

MEDICAL AND SCIENTIFIC EVIDENCE.

My enquiries are based not on newspaper reports got up to scare the public, but from medical and sanitary journals. In

these cases medical men have given reports, which prove to demonstration that cases of poisoning do occur, and that som have proved fatal. As medical officers of health we are boun to take notice of this, and as custodians of public health t suggest such measures as shall safeguard the health and lives o the people.

I have collected, grouped, and epitomised reports of poisonin from canned foods that have appeared in the medical journal since 1879. Probably I have not observed all the cases reported.

Class A.—Poisoning from Canned Meat.

This includes Beef, Mutton, Rabbits, and Tongues.

1.—1879. Twenty-one persons made ill from eating canned tongues, reported by Dr. Brown, Bacup. "British Medical Journal," 1879.

2.—1882. Family of five persons in Northampton. Canned meat. "British Medical Journal," 1882.

3.—1882. Family in Middlesborough. Tinned meat. "British Medical Journal," 1882.

4.—1885. Three persons in Edinburgh. Canned meat. "British Medical Journal," 1885.

5.—1885. Boy died from eating canned meat. "Lancet," 1885.

6.—1887. Father, Mother, and child aged 18 months; the latter died. Canned Mutton. "British Medical Journal," 1887.

7.—1887. Man, wife and child. Canned tongue. "British Medical Journal," 1887.

8.—1889. Child died from eating the scrapings from empty meat cans at West Bromwich. "British Medical Journal," 1889.

9.—1890. Man and wife died from eating canned meat. "British Medical Journal," 1890.

10.—1892. Family in Oldham. Tinned pigs' tongues. Reported by Dr. Sutton.

11.—1892. Family of eight persons. Canned Beef. "British Medical Journal," 1882.

12.—1892. Woman died from eating canned beef. "British Medical Journal," 1892.

13.—1892. Family poisoned by ox tongues. "British Medical Journal," 1892.

14.—1895. All the members of two families from eating tinned meat. One proved fatal. "British Medical Journal," 1895.

Class B.—POISONING FROM CANNED FISH.

1.—1884. Three persons made ill by eating tinned salmon at Great Bowden. "Lancet," 1884.

2.—Mother and son; the latter died. Tinned salmon. "British Medical Journal," 1884.

3.—1885. Professor Attfield reported a case of death from eating canned salmon.

4.—1887. Death from eating canned salmon reported in "Sanitary Record," 1887.

5.—1888. Family made ill. Reported by Dr. Wear. "Lancet," 1888.

6.—1891. Six persons in London; one died. Canned salmon. "British Medical Journal," 1891.

7.—1892. Gentleman ate six sardines and died; his servant ate one and was ill. "British Medical Journal," 1892.

8.—1896. Four persons made ill; one died. Canned salmon. "British Medical Journal," 1896.

Class C.—POISONING FROM CANNED FRUITS.

1.—1884. Six persons made ill. Canned tomatoes.

2.—1890. Four persons poisoned by canned cherries. "British Medical Journal," 1890.

3.—1893. Family of six persons poisoned by canned tomatoes. "Public Health Epitome," 1893.

Salts of tin were found in the liquor of each can in Class C.

In Class A there were six deaths.
In Class B there were six deaths.
In Class C none were reported.

A. Canned Meats.—The poison is probably due to one of the ptomaines, which are of bacterial origin, and may have been produced (1) before the meat was canned; (2) after canning; and (3) after being opened. In the first the toxic properties are probably rendered inert by the steaming process, but the nutritive value of the meat is lessened. In the second case the can is usually in that condition technically known as "blown." The gases produced by putrefaction causing so great internal pressure that the ends are convex instead of concave. There is little danger of anyone consuming these, as the putrid condition and bad smell are so manifest. Thirdly, after being opened under certain conditions of the atmosphere, as humidity and temperature, foods are rapidly acted upon by bacteria, which form toxines, some of which are more dangerous than mineral poisons. This is particularly so in regard to fish, salmon being the worst. It is only just to say that the wholesale and retail

traders are most careful in examining cans and rejecting those which are blown or pierced. This is in all probability why the cases of poisoning are not more frequent.

B. Canned Fish.—In this ptomaines are the chief poisons, salmon being the kind of fish which in nearly all cases has been associated with poisoning. From what one has read in the daily press and from the physical conditions of some cans of salmon it is probable that a good deal of it undergoes putrefactive changes before being canned. We have seen salmon which has had a paleish, yellow colour, soft, and friable, in contrast with the firm, red, and flaky appearance of sound muscle. Canned salmon is not very popular with the public. The great canning firms will do well to take all necessary steps to ensure that all meats and fish are prepared and canned under the strictest hygienic conditions.

C. Canned Fruits.—In these the salts of tin and zinc have been the poisons. I am not aware of any case having ended fatally. The symptoms have been those usually associated with metallic poisons. From the analyses which I have made I find that cans in which lead is used in tinning or soldering that these are present in the fruit and syrup, due firstly to the action of natural acids, and secondly due to galvanic action. The amount of lead in some pears and apricots was such that in time it would produce plumbism with its manifold symptoms. The amount of metal in some cans was sufficient to give the fruit a metallic taste.

At least one case has proved fatal from lead poisoning in a child. Professor Lowry, of Baltimore, made a post mortem, and found lead in the viscera, also in the oil and sardines remaining in the tin. The verdict was "Death from lead poisoning from a sardine tin improperly soldered."

Some Chemical and Physical Observations.

1. *Acid Reaction.*—There was an acid reaction in all the liquids of the cans of meat, fish, and fruits except one, a can of oysters, which was almost neutral or feebly acid. The acid was organic; no mineral acids.

2. *State of the Tins.*—More or less corrosion and discolouration present when metallic salts present in the liquid.

3. *Metallic Contamination.*—In meats the metal is chiefly found where it is in contact with the soldering and plating; in fruits it is present in the syrup; also throughout the substance of the fruit. In the syrups, with but one or two exceptions, a certain amount of tin and lead (when terne plating has been used) have been present. Mr. Wynter Blyth examined over twenty cans of fruits, and found tin in every one, the amount

being 1·58 to 11·05 grains per lb. Dr. Sedgwick also found tin salts in every case of apricots, pine apples, peaches, and tomatoes, that he examined. Dr. Luff examined syrup from a can of cherries, which had caused metallic poisoning, and found the enormous amount of 1·9 grains of oxide of tin for each ounce of juice. Each person poisoned had taken from four to ten grains of malate of tin.

4. *Plating and Soldering.*—Being fortunate in having a number of canned foods for examination, I am able to compare the plating and soldering of over twenty years ago with that of to-day. The old cans, when opened, showed a bright, silvery appearance, and the soldering free from corrosion, and very narrow seams. No lead was to be detected in the plating. Two cans which were of recent date had double sealings, one was lobster and the other salmon. Both were suspicious in their physical appearances. None of this stamp were discovered among the old firms. It has been stated that some American firms reseal blown tins. The cans then have their former normal concave appearance again.

Effects of Age.

All canned foods are better for being used soon after canning. How long foods hermetically sealed will keep is not definitely known. Fortunately, having had canned foods, including meats, soups, rabbits, giblets, oysters, etc., of from twenty to thirty years old, I found that the tins, though rusty outside, were perfectly good inside, none were blown. The meats were sound, though not as fresh and tempting to the eye as recently canned foods. One family, consisting of seven persons, consumed over 20 cans, and another lot of 13 canned rabbits was partaken of by a club. In no instance was anyone made ill. In canned fruits the effect of age is of greater importance, as the acids of the fruit dissolve by chemical and galvanic action the plating and solder. It has been shown by Professor Guteau, of Paris, that the amount of metal increases with age as follows: 1st year, 1·2 mil. grs. per kilogram; in two years, 2·1 mil. grs.; and after three years, 4·2 mil. grs. per kilogram.

Hints on its Prevention.

What the Trade should do.—All the canning stations for meats, fish, and fruit should be under the control of such by-laws of the sanitary authorities as will ensure that all the conditions necessary to the purity and soundness of the goods are enforced. In canned fruits it is very rarely that one can detect any decayed fruit, the fruit as a rule being exceptionally

fine. 2nd: If canned goods are to be continued it is necessary that the plating should be of pure tin, unless a satisfactory substitute can be discovered. In recent times the plating has seriously deteriorated, an alloy of tin and lead being used, containing two parts of tin to one of lead, and in some cases as much as two of lead to one of tin. This alloy is called "terne plate." I find this is most common in canned fruits. The severe competition has no doubt brought about this serious deterioration, since the plating tin costs £62 per ton, whilst lead costs only £14 per ton. (3) All canned goods should be kept in a cool and dry place. Shop windows should not be filled so that the tins are heated. In canned fruits this especially is harmful, as it promotes alcoholic fermentation. The syrup is very watery, being only about specific gravity 1140 to 1180. I believe that a well boiled syrup of 1250 spec. gravity would have less tendency to ferment. Fruits should be whole and unskinned, so that any metallic salt in the syrup would not saturate it. "Terne plated" cans should be forbidden for all goods, but especially for fruits. (4) Fruits preserved in jars or bottles are more desirable. Canned foods have three factors greatly in their favour: 1st, cheapness—about 10s. per gross for 1lb. tin; (2) lightness; (3) durability. Jars have three factors against their use: (1) cost—18s. gross for 1lb. jars; (2) weight; (3) fragility.

Hints to Consumers.

Avoid cheap brands, there is 50 per cent. difference between the best and cheapest. Only purchase canned foods that have the name on them. Keep in a cool place. When opened empty the contents at once into a jar or glass vessel. Consume the same within one or two days, as some canned foods rapidly undergo chemical changes, especially fish, such as salmon. Blown cans of meat and fish should be thrown away. Blown fruit is really no worse in regard to colour, taste, and appearance, as the result of alcoholic fermentation. The only danger is that there may be metal in the syrup or fruit. In regard to canned fruits, pears and apricots have shown the largest amount of dissolved lead and tin, probably due to the large amount of acid in the juice of these fruits. Pine-apples have shown the least amounts, and in my opinion they are the safest fruit to buy under the present mode of canning. Avoid all fish, especially salmon, that has a yellowish soft and friable condition, showing that putrefactive changes have taken place before canning. Examine the plating of the inside of the can. This should have a silvery white appearance; if it is corroded,

reject it. If it has a blueish slate colour it will be risky, especially if it contains fruit. The plating has been done with an alloy of tin and lead. In some cases I have seen the soldering 1½ in. wide. Cans doubly sealed with soldering are suspicious. I had two tins, one salmon, and the other lobster, both suspicious. In my opinion there should be a non-metallic coating for cans, which should be perfectly safe.

Suggested Substitutes for Canning.—Probably a light, cheap, and durable substitute may yet be found, and solve the problem. Aluminium is abundant in nature. The earth's crust only needs scratching to find it in all our clays and shales. An inventor with the genius of a Bessemer may do with aluminium what Bessemer and Siemens did in the production of steel from iron. Aluminium is tough, fibrous, light. Aluminium atomic weight is 27·3, iron 56. It is non-oxidisable, insoluble in organic acids. It would require no plating, Hydrochloric acid dissolves it, hence this acid should not be used as a flux. If aluminium should be dissolved, its salts are not so dangerous as those of tin and lead. The price of aluminium is at present too high.

What The Government Should Do.

(1) Forbid the importation of canned foods in which the tin used for tin plating contains more than one per cent. of lead, or more than ten per cent. in the solder. This law has been in force in Germany since 1889. (2) That the soldering should be on the outside of the can. This regulation is enforced in France and Germany. (In one recent can I found over 40 grains of solder amongst the fruit.) (3) That the date of canning should be legibly stamped on each can. This is very important in regard to fruits. It has been proved by Professor Gautier, of Paris, that the amount of metal dissolved increases with keeping.

The following important resolution was passed :—

"In view of the evidence submitted to the Conference of Medical Officers of Health, held in connection with the Congress of the Sanitary Institute at Leeds, they recommended the Council of the Institute to urge the Government to inquire into the prevalence of cases of illness due to the use of canned foods, and to adopt such action as the evidence would justify."

(For action taken by the Council see p. 132.*)*

A paper was read by Prof. S. Delepine, M.B., B.Sc., on "*Bacteriological Diagnosis as applied to the Notification of Infectious Diseases.*"

" *The Furnishing and General Administration of Small Isolation Hospitals*," *by* MEREDITH YOUNG, M.D., D.P.H., Medical Officer of Health, Borough of Crewe.

THIS question is one which I think of interest to Health Committees and Health Officials generally, and it is one on which it is extremely difficult to obtain detailed information. I have spent an immense amount of time in working out details from various sources, and I have now much pleasure in laying these before you. From the very nature of the subject such a paper as mine can only be scrappy, and I need not therefore apologise for that defect.

The *Administration Block* may be furnished pretty much as an ordinary private house, but in the wards there are several special articles of furniture to consider. The most important piece of furniture in the whole Hospital is undoubtedly *the bedstead*. If it be not comfortable the patient will suffer, and if it be not strong and well made, it will not stand against the constant wear and tear of hospital life—for a hospital bedstead, unlike a private one, gets no rest day or night, it may be for months together. The bedstead then should be all iron, with double or treble galvanised wire-wove mattresses, and with tubular and not angular sides. The castors should be of lignum vitæ preferably, and not china bowl, for the latter chips and is then liable to scratch the floor.

These castors should be supported on malleable iron horns—the horns being usually the weakest part of a castor.

The Cots should have both sides to slide down, not to fall outwards, and the sides are better to be the same height all round, or very nearly so, to prevent restless children climbing out. They are better without brass knobs, for children constantly screw these off for playthings. If they look sombre without these knobs, they can be enamelled in white or French grey.

Mattresses are best made of horsehair, and for a bed 6 ft. 3 ins. long by 3 ft. wide should contain 21 lbs. of good curled horse-hair.

You will raise a hornet's nest about your ears if you specify this, for the makers of these things think nothing of a mattress which is not thick and heavy. A thick mattress is not required where a woven wire mattress is placed beneath it, and thickness is a decided disadvantage when disinfection has to be

frequently done. The root of the objection raised by mattress-makers is obvious; it is that *good* horsehair weighs very light. Cloth tabs or tufts are better than leather ones, as they stand disinfection better. Cot mattresses of a fairly common size, 4 ft. 6 ins. by 2 ft. 6 ins., should contain about 12 lbs. of good curled horse-hair.

All mattresses should have covers of strong unbleached linen—they save a good deal of wear.

In the matter of pillows opinions differ, some preferring feathers and others wool. For myself I never wish anything softer, cooler, or more comfortable than one filled with clean white wool flocks. If feathers are used it should be seen that the inside of the pillow tick is bees-waxed, and not merely soaped.

The *patients' lockers* are perhaps the next most important item, and I have spent much time in designing one to meet the necessary requirements.

This is made of polished pine and is about 28 to 30 inches high, the height being such that the patient can easily reach the top of it when lying down in bed. The top is 16 inches wide by 14 inches deep, and has a thin brass rail with screw pillars to run round three sides of it—thus avoiding corners for dust which would be found if a wooden strip or rail had been used. The top should be made with a white glass plate $\frac{3}{16}$ to $\frac{1}{4}$ inch thick, firmly and evenly bedded and let into the wood; the bedding of this glass plate is extremely important, as if it be uneven the glass will be unsupported at some part and will probably break when some such thing as a soda water syphon is put down clumsily on it.

The locker has a drawer, 6 inches deep with plain wooden knob, for private valuables of the patient, and a cupboard 18 inches deep beneath this with a wooden knob and catch. The locker is mounted on four stout wooden legs on castors, and the legs should form part of the sides of the locker and not merely be screwed on to the bottom of it. These legs are 4 inches long and will allow a sweeping brush to pass under the locker. At the *back* of the locker is a towel-rail—these are usually put at the sides, and if the towel be at all soiled it does not look pretty in full view of the ward. These lockers should not cost more than from £1 to £1 2s. 6d. apiece.

A curious double locker with bed-table combined was designed, I believe, by my friend, Dr. C. K. Millard, of the Birmingham City Fever Hospital, to whom I am indebted for many valuable hints on the subject of furnishing. It consists of a double locker with a special removable top which does duty as a bed-table. I believe Dr. Millard admits its disadvantages, which are:—firstly, that it is only very little cheaper than the

three articles separately and that sometimes the two patients for whose use it is intended both want to use it at the same time.

I am aware that some people object to having lockers in an infectious ward at all because of the infection, and prefer to keep all the patients' clothing in a special store-room. But a patient always has a few things that he wishes to keep near him, and the ward usually developes a most untidy appearance if there be no special place for them. It is quite an easy matter to have a "locker morning" and to have them all turned out and all rubbish removed.

In the Birmingham Fever hospital, I observed with great pleasure that in the scarlet fever block a special low table 20 inches high, was provided for children. They can then sit to their meals and have their feet resting on the floor instead of swinging in mid-air. This table also did duty as a bench for 6 or 8 children on days when feet were to be examined; if they got restless while waiting for the doctor they had not far to tumble.

Easy chairs in a fever ward are generally of a bare and uneasy type, without any cushions and with many angles. I do not see why this need be so, for the cushions can be removable and tied on with tape; they can then readily be detached and disinfected, and the framework scrubbed with soap and water or sprayed with perchloride.

The ward screen should be of polished pine or birch, and should resemble as much as anything an ordinary clothes horse, with coloured washing cretonne tied on and hinged with brass hinges to open either way.

There is a craze at present against the use of cocoa fibre door mats for ward entrances, presumably on account of their power of retaining infection, and wire mats are recommended in consequence. But those who have tried wire door mats know that they are nothing more than scrapers which do not remove the wet off one's boot soles, but the surface dirt only, and I believe it is almost universally found that fibre mats are needed in addition to the wire mats. I see no difficulty in the disinfection of these fibre mats, for if it is not possible to put them through a steam disinfector they can be soaked for hours in perchloride solution, and it will also do the fibre good.

There is sometimes a difficulty in the carrying of patients' food across from the administrative block kitchen to the wards, and in order that the food shall be warm when it reaches the patients, I think the best things to use are enamelled iron luncheon carriers similar to those made by Mr. E. Kirk, of the town of Leeds.

In connection with the *baths* of an isolation hospital, it is important to make provision in the scarlet fever block, in this

respect as well as in many others, for the special needs of children, and I strongly recommend a plan I saw at the Birmingham Fever Hospital, of having the baths in the first place small in size (and therefore economical of hot water), and in the second place raised on a concrete foundation some 6 or 8 inches from the floor. The latter plan is excellent inasmuch as it saves the nurse's back when she has half-a-dozen children to bath.

Another useful modification I saw at the same Institute, was a bath placed in the centre of a room, and with a wide board all the way round the top so that children could sit down, half a dozen at a time, and soak their feet when desquamating.

Some consideration should be given to the material of which baths are made. Putting copper ones aside as too expensive, we have three principal kinds left—enamelled iron (cast iron), zinc and porcelain.

1. The enamelled iron ones are inexpensive and usually good, but they take up a lot of heat from hot water, and they rust and discolour if the enamel gets chipped.

2. Zinc baths are not lasting—the bottoms bend out of shape, and they seldom look clean or inviting.

3. Porcelain baths last a long time, and have a very pleasant smooth surface. They are very heavy, and absorb a great deal of heat from hot water—though this is not a disadvantage, where many people have to be bathed quickly one after another.

Their smoothness may at times—though it is only rarely—prove a drawback, from old people or invalids slipping on them.

The outlet of the bath should be large—1½ ins. in diameter or more—as if it be small the bath will take a long time to empty, and patients and nurses will be kept waiting. The inlets and outlets, or supply and waste, should be entirely separate ; if they are both at the same orifice, some of the dirty water from the previous bath will be washed back by the clean water entering. Waste of water too with this combined arrangement can go on unnoticed.

Bath thermometers of a very useful kind are made with a copper wire fastened to the top of the thermometer, and continued upwards for six or eight inches, then bent round in the shape of a hook so that they may be hung over the side of the bath, the bulb only being immersed.

The ward thermometers may very usefully be made with a contracted scale—from 50° F to 70° or 75° F—and with a lens front so that the indicating column will be magnified, and can be seen at a distance. It is useful to have temperature charts kept in the wards for recording *ward* temperatures; these should be marked at regular intervals of four hours or so by the nurse in charge of the ward, and the medical officer or matron

can then see at a glance if there be any great irregularity in temperature. This plan also serves as a means of drawing a nurse's attention to the temperature of the ward.

In the lavatories I do not think a more useful fitting can be found than Twyford's patent slop-sink; the bed-pans are emptied into this—held upside down—a tap turned, and a jet of water is sprayed upwards so as to wash out the pan without the necessity of the nurse using her hand for it.

If possible in the lavatory a draining rack or shelf should be provided for bed-pans, and I have an idea for this to be made in such a way that the water draining from them is conveyed along an inclined impervious shelf to the slop-sink direct, and the bed-pans are warmed by means of a coil or loop of hot water pipe from the lavatory adjoining which circulates under the shelf on which the bed-pans rest. I have not yet worked out the details of this but it appears a feasible scheme.

The provision of coals to the wards is often a troublesome detail to arrange, and so far as I can see it may be managed in one of three ways:—

1. By having four or five coal scuttles filled every morning and evening if necessary, by the porter, and stood in the verandah outside or passage inside the pavilion.

2. By having a large wooden cupboard close to the ward entrance outside, the porter to fill this as often as required. This is usually unsightly, and the nurses have after all to go outside for their coal.

3. By having a coal-bunker on wheels similar to that made by Messrs. T. Bradford & Co., of Manchester. This can be made in ornamental wood and with rubber tyres on the wheels so that it can stand in the entrance and be wheeled into the wards when required.

In connection with this subject, if the hospital is to be heated by means of steam pipes, it is advisable to have any steam radiators which may be erected protected by wire netting; otherwise the children will continually be burning their fingers.

There are many other matters of detail which mean comfort to patients and ease in administration, but time does not permit me to touch upon these. I pass now to a brief consideration of various plans of the *general management of an Isolation Hospital.*

Commencing with very small places, a common practice of hospital authorities is to engage a man and his wife as caretakers and general managers of the hospital, allowing them to live rent free in return for their looking after the place, and when it is occupied perhaps paying them a little extra.

This appears excellent on paper, but I have several objections

to it. The most serious is that the people are very often employed by the authority to act as nurses, and no one here will, I am sure, advocate anything else than that sick people should have the benefit of a properly trained nurse. It is, as we know, a question of life and death in typhoid fever. An ordinary caretaker and his wife, too, are very rarely trained in the measures necessary to prevent the spread of infection, and if this be so the utility of the Isolation Hospital becomes impaired.

The second objection is, that when the authority utilise the man and wife as caretakers simply, and get properly trained nurses when the hospital is occupied, there is often a dispute as to authority—the caretaker looking upon himself as lord of the place—and the nurses suffer from inattention to their wants.

In all such cases as these I think it is of the greatest importance to impress upon the caretaker and his wife that the wants of the nurse must be their first thought, and they must be made to understand that the nurse is the more responsible person and must be respected accordingly.

It must be remembered that when friction does arise in this manner the innocent patient is the principal sufferer.

Still another objection to the "man and wife" system is that one seldoms finds the two people equal in working qualities, that is if you manage to secure an energetic woman you have often a good-for-nothing husband tied on to her apron-strings.

Where this system is inevitable, however, the Medical Officer of Health, before engaging the caretakers, will do well to pay them a surprise visit at their own home and see how that is kept.

The next system of administration for small places is to have the hospital staff to consist of a permanent nurse matron, with one general servant, one or more nurses, according to the number of patients in, and a porter to live off the premises—the latter to act as ambulance man, disinfector, gardener, boots, and odd man generally.

This staff should suffice for a hospital accomodating up to about twelve patients, the matron to take a share of nursing and help with bad cases, and to engage laundry women from outside. It is important for the porter or odd man to live within easy call, for amongst his duties will be that of helping to remove dead bodies to the mortuary—a thing which may have to be done in the middle of the night, and of helping with delirious patients (and we all know how very rapidly a patient may become violently delirious).

Authorities constantly complain of the expense of maintaining a fever hospital, with perhaps only three or four cases in,

forgetting that separate diseases need separate nurses. This is a thing which cannot be helped by any means—it must be looked straight in the face.

Where the hospital is to accommodate over twelve and up to twenty or more patients the housekeeping duties of the matron will prevent her acting as a nurse except in the way of general supervision.

The nursing staff will, of course, have to be increased as the patients increase, and so will the servants or attendants, and taking these altogether the matron will have a fairly large party to organize. A word as to the matron's qualifications. She should, of course, be a fully trained nurse, or some difficulty will be found in getting trained nurses to act under her. She should, if possible, be of a higher social status than her subordinates, for though dignity in excess may be undesirable it is not so lamentable as to see a break down in discipline and organization resulting from the matron of a large establishment taking tea in the kitchen with her own cook! The matron should have the power of engagement and dismissal of nurses, servants and attendants, or if not this, certainly of all the female staff.

A Committee cannot judge so well as she of the qualifications of a nurse or of a servant, and this power of dismissal is a wonderful help to the smooth working of an establishment. Committees who have been badgered by nurses appearing before them to state their grievances will uphold the truth of my contention.

The next question to which I would direct your attention is one of great importance, especially in the case of hospitals just about to be opened. Shall the medical men of the town attend their own cases, or shall their responsibility cease when they have notified to the Medical Officer of Health that the case is one for removal?

My own opinion, after a great deal of consideration of the question is that it is not advisable in the large majority of cases for practitioners to attend their own patients at the Isolation Hospital. The only exception I would make is this—that where a patient after having it clearly explained to him that so far as medical attendance at least is concerned he will not be charged anything by the Hospital authorities, but that if he has his own doctor he must pay his own doctor's bill, if after clearly understanding this he makes it a condition of removal that he shall have his own medical man, then I would most certainly say let him have his own doctor, but the patient must be removed. Isolation of the patient must be our first consideration. If we have half a dozen doctors attending their own

scarlet fever cases it will to a very large extent undo the good effects of isolation, or, in other words, the daily visits of several medical men to a building in which infectious cases are congregated will be fraught with danger to the community. Medical men of the opposite view will say:—"I can take precautions by putting on a cloak, disinfecting my hands, &c., and I shall be no more likely to carry infection than the Hospital Medical Officer who will probably be the Medical Officer of Health, and will be in this capacity visiting the houses of the people." This is quite true, but it stands to reason that there is not so much risk, by a good way, of one medical man carrying infection as there is of half a dozen, and, it must be remembered the private practitioner may go straight from the Fever Hospital to the bedside of a sick person who is in a state to receive infection, whereas the Medical Officer of Health deals not with the sick person himself but with his surroundings. The private practitioner may say "I can arrange my visits so that I call at the Fever Hospital last, and therefore the objection that I may go straight from it to a sick person's bedside does not hold." My answer is that it needs a very strong mind to sacrifice convenience to conscience on a busy day, and even if the Hospital visit be carefully left to the last the practitioner may be called into a house urgently five minutes after he has left the Hospital.

As a rule, I believe, practitioners, though they may fight strongly at first for their right to attend their own cases, very soon give it up, finding it damaging to their practice.

I have in my mind one fairly large district in which this has been the case. There are other objections to this course of medical men attending the fever hospital and potent ones, but time compels me to omit their consideration.

Though I have thus argued against the regular attendance of private practitioners at the Isolation Hospital, it must clearly be understood that if the patient or his friends desired a consultation or if the case assumed a serious complexion, the hospital medical officer would in common professional courtesy communicate with them.

Should the question come up before any hospital committee I certainly think that nothing can be lost and much may be gained by a conference between the hospital committee with their medical officer and the local practitioners. And even if practitioners be allowed to attend their own cases it is always as well to leave the general superintendence of the hospital in the hands of the Medical Officer of Health, who should alone be responsible for the admission or discharge of patients.

Passing on to the general regulations of the hospital, there

are just two points of special importance, but which are not generally adopted:

1. The ambulance attendant should be instructed in no case to remove a patient unless he has a medical certificate of fitness for removal, or what is a better arrangement, he should take his instructions for removal of cases from the medical officer only, who in his turn should insist upon this medical certificate.

2. It is as well, considering the doubtful termination of the infectious period in scarlet fever, to send to the parents of each case, on its discharge, a written notice stating that although every precaution has been taken it is impossible to guarantee absolute freedom from infection and therefore the child should not, for a week, or two, be allowed to sleep with other children, or be sent to school, but should, if possible, have a couple of weeks in the country.

I may, perhaps, be permitted, in terminating this somewhat lengthy paper, to give briefly the average cost of the upkeep of isolation hospitals. Exclusive of interest on the construction of the hospital, and including all salaries and wages, the cost of upkeep should be about £25 per bed per annum.

The cost per patient will be about £10 or £12 per annum, for current expenses only—salaries, wages, &c., exclusive of interest on cost of construction. There is, however, a very wide difference in different institutions. The cost of furnishing will not I think in any case be less than £15 or £20 per bed.

"*Tenemented Buildings, and Duties on Inhabited Houses,*" *by* JOHN F. J. SYKES, D.SC., M.D., Medical Officer of Health, St. Pancras.

(FELLOW.)

WHEN your Recording Secretary asked me if I would read a paper before this Conference, giving some account of the Customs and Inland Revenue Acts, so far as they affected Artizans' Dwellings, I cheerfully acceded to the request to lay before Medical Officers of Health such knowledge and experience of the subject as I had gained. Accordingly, I determined to make the subject as complete as possible, and to begin at the beginning, and then my troubles began also. I experienced many difficulties in obtaining historical information, but I hope that

the information which I am about to lay before you—and which has never before, to my knowledge, been collated—will prove acceptable.

It was not until the 3rd century that glass appears to have been used in windows in Europe.

It was not until the end of the 12th century that glass was used to any extent in the windows of private houses in England.

The glass had to be imported then, and it appears to have been regarded as a luxury.

In Britain a window-tax was first imposed in 1695, was several times increased, and in 1850 produced £1,832,684.

The effect of this window-tax must undoubtedly have been to exclude much light and air from dwellings, and knowing as we do the value of light and air, it is surprising how little notice is taken in most works upon public health of the imposition of this tax, and of its repeal. And yet its repeal must have largely contributed to the improvement of the public health.

For the purpose of more strictly assessing this window-tax, in the year 1808 the following provision became law:—

48 George III., c. 55.—Schedule B.

Rules for charging Duties payable on Inhabited Dwelling Houses.

Rule VI.—Where any house shall be let in different storeys, tenements, lodgings, or landings, and shall be inhabited by two or more persons or families, the same shall nevertheless be subject to, and shall in like manner be charged to, the said duties as if such house or tenement was inhabited by one person or family only, and the landlord or owner shall be deemed the occupier of such dwelling house and shall be charged to the said duties; provided that where the landlord shall not reside within the limits of the collector, or the same shall remain unpaid by such landlord for the space of twenty days after the same is due, the duties so charged may be levied on the occupier or occupiers respectively, and such payments shall be deducted and allowed out of the next payment on account of rent.

Under this provision a very important case was decided in 1851, the case (No. 2207) of the Model Lodging House in Streatham Street, Bloomsbury Street, St. Giles, Middlesex. (As the cases quoted in this paper are very important they are quoted in full in the Appendix.) This case was an appeal by the owners, against an additional assessment made for 228 windows in the premises, the owner claiming that the building was not one dwelling-house, but consisted of many distinct tenements, and that the access to each story was by one staircase on the outside, and by external galleries open to the air used

as roadways to separate and distinct dwellings, each with its own outer door. Three of Her Majesty's Judges, who heard the appeal, decided in favour of the appellants who were successful, and the assessment was discharged.

In the same year the window tax was repealed and the following Act became law, but Rule VI., Schedule B of 48 Geo. III., c. 55, still governed the manner of assessment as it does to the present moment:—

14 & 15 VICTORIA, c. 36.

An Act to Repeal the Duties Payable on Dwelling Houses according to the number of windows or lights, and to grant in lieu thereof other Duties on Inhabited Houses according to their annual value. 1851.

* * * * *

SCHEDULE.

The Duties by this Act made payable upon inhabited dwelling houses in and throughout Great Britain, according to the annual value thereof; that is to say—

For every inhabited dwelling house which, with the household and other offices, yards, and gardens therewith occupied and charged, is or shall be worth the rent of twenty pounds or upwards, by the year,

Where any such dwelling house shall be occupied by any person in trade who shall expose to sale and sell any goods, wares, or merchandise in any shop or warehouse, being part of the same dwelling house, and in the front and on the ground or basement storey thereof;

And also where any such dwelling house shall be occupied by any person who shall be duly licensed by the laws in force to sell by retail beer, ale, wine, or other liquors, although the room or rooms thereof in which any such liquors shall be exposed to sale, sold, drunk, or consumed shall not be such shop or warehouse as aforesaid;

And also where any such dwelling house shall be a farm-house occupied by a tenant or farm servant, and *bonâ fide* used for the purposes of husbandry only;

There shall be charged for every twenty shillings of such annual value of any such dwelling house, the sum of sixpence.

And where any such dwelling house shall not be occupied and used for any such purpose and in manner aforesaid, there shall be charged for every twenty shillings of such annual value thereof the sum of ninepence.

Under this Act, and Rule VI. of Schedule B of 48 Geo. III., c. 55, five leading cases were fought, of which the two first failed, and the three last were successful. These cases were those of—(No. 2262) the Albert Family Dwellings, in Underwood Street, in the Hamlet of Mile End New Town, Middle-

sex, 1852; (No. 2297) Pancras Square, Platt Street, Camden Town, Middlesex, 1853; (No. 2328) the Model Lodging House, Streatham Street, Bloomsbury Street, St. Giles, Middlesex, 1853; (No. 2349) Model Houses in King's Arms Gardens, St. George's-in-the-East, Middlesex, 1854; and (No. 2470) Model Dwellings in Flask Walk and Brewhouse Lane, St. John's, Hampstead, Middlesex, 1858.

It is worthy of note that the successful case as to the mode of assessment with regard to the window-tax in 1851 was—in respect of the same building—also the first successful case as to the mode of assessment of inhabited house duty in 1853, namely, the Model Lodging House, in Streatham Street, Bloomsbury Street, St. Giles.

The outcome of this was and is that in blocks of artizans' dwellings constructed with staircases open to the air at the sides, not necessarily above, the separate and self-contained dwellings were and are assessed separately, and not as those in one dwelling-house, all together—one dwelling-house meaning a building between four party walls. The effect of this peculiarity was and is to exempt separate and self-contained dwellings under £20 a year rental from inhabited house duty altogether, if the dwellings are approached by a staircase or gallery open to the air.

It must be admitted that in large blocks of dwellings it is particularly desirable that the separate dwellings (and families) should not be in aërial communication by means of internal and enclosed passages or staircases, and so far the effect of the decisions were and are beneficial.

It will be observed a little later that in some other respects the effect in relation to later Acts is anything but beneficial, as it enables otherwise badly constructed buildings to escape the influence of subsec. (2) sec. (26) of the Customs and Inland Revenue acts of 1890. And there are a number of such buildings, some constructed many years ago, some recently, some in course of construction.

No doubt many owners, whether philanthropic associations or private individuals, whose blocks of artizans' dwellings possessed inside staircases and corridors, whether properly lighted and ventilated or not, felt aggrieved that upon their buildings they were obliged to pay an inhabited house duty of ninepence in the pound.

Accordingly by letter dated the 8th February, 1884, the Board of Inland Revenue obtained from the Treasury a general authority to exempt from Inhabited House Duty Blocks of Artizans' or Labourers' Dwellings when they found upon inspection that the occupiers really belong to the working

classes, and that each tenement or set of rooms is under the annual value of *£20*, and would therefore have been exempt had it formed a separate house or cottage, duty however being paid prior to the grant of exemption for the rest of the block in respect of any holding in the block of which the value exceeds *£20* per annum.

The Treasury Concession was limited to cases where each separate dwelling was *self-contained* and structurally severed from the rest of the building.

The effect of this was to put all blocks of separate and self-contained dwellings on a similar footing in reference to exemption from Inhabited House Duty, without any regard to their sanitary structure or condition.

This gave rise to further grievances inasmuch as, in those cases where it was held that the dwellings were not truly self-contained there was no exemption, and many of the more self-contained style of dwellings insanitarily constructed, obtained an exemption not granted to many of the less self-contained style of dwellings, although the latter might be sanitarily much more perfect than the former. These further grievances it was hoped to remedy by superseding the Treasury Minute of the 8th February, 1884, by the Customs Inland Revenue Act, 1890, section 26, sub-section 2, which it is desirable here to quote in full, as well as the amending section 4 of the Act of 1891 :—

Customs and Inland Revenue Act, 1890.

53 & 54 Vic. ch. 8. Sec. (26), Sub-Sec. (2).

The assessment to inhabited house duty of any house originally built, or adapted, by additional alterations, and used for the sole purpose of providing separate dwellings for persons at rents not exceeding, for each dwelling, the rate of seven shillings and sixpence per week, and occupied only by persons paying such rents, shall be discharged by the said Commissioners, provided that a certificate of the Medical Officer of Health for the district in which the house is situate, or other Medical Practitioner appointed as hereinafter provided, shall be produced to them to the effect that the house is so constructed as to afford suitable accommodation for each of the families, or persons, inhabiting it, and that due provision is made for their sanitary requirements.

The Medical Officer of Health of a district, on request by the person who would be liable to pay the house duty on any house in the district if the duty were not discharged as aforesaid, shall examine the house for the purpose of ascertaining whether such a certificate can properly be given, and if the house be constructed so as to afford such accommodation, and due provision be made as aforesaid, shall certify the same accordingly; provided that the Authority, if they

are of opinion that the duties which would devolve on the Medical Officer of Health under this Section could not be performed by him without interference with the due performance of his ordinary duties, may appoint some other legally qualified medical practitioner, having the qualification required for office of Medical Officer of Health of the district, to make such examinations and give such certificates as aforesaid.

As respects Scotland, the expression "Medical Officer of Health" means a Medical Officer within the meaning of the Public Health (Scotland) Act, 1867.

Customs and Inland Revenue Act, 1891.

54 & 55 Vic. ch. 25. Sec. (4).

4. (1) Sub-section two of section twenty-six of the Customs and Inland Revenue Act, 1890, is hereby amended by the substitution of the words "where the annual value of each dwelling shall not amount to twenty pounds," for the words "for persons at rents not exceeding for each dwelling the rate of seven shillings and sixpence a week, and occupied only by persons paying such rents."

(2) In the case of any house originally built or adapted by additions or alterations, and used, so far as the same is used as a dwelling house, for the sole purpose of providing separate dwellings at an annual value not exceeding forty pounds for each dwelling, the Commissioners acting in the execution of the Acts relating to inhabited house duties shall, upon production of such a certificate as is mentioned in the said sub-section, grant relief by confining the assessment to the annual value of the house exclusive of every dwelling therein of an annual value below twenty pounds (if any) and by reducing the rate of duty to threepence.

(3) The provisions of the said sub-section in relation to a certificate shall apply to a certificate to be produced under this section.

The effect of these newer enactments with regard to inhabited house duty is (1) to exempt from duty all dwelling-houses containing separate dwellings (the words self-contained are omitted) under £20 a year rental value, and (2) to reduce the duty from ninepence to threepence upon dwelling-houses containing dwellings of £20 a year and over but under £40, the annual value of any dwellings under £20 a year having been first deducted—provided that the certificate of the Medical Officer of Health be produced to the Commissioners.

Two points strike one as requiring elucidation in the provisions of these acts of 1890 and 1891: the first is, can anybody demand that a Medical Officer of Health should examine any house, for the purpose of obtaining a certificate, without first supplying proper evidence from the Surveyor of Taxes of the district? and the second is, what standard do the provisions intend should be adopted in the certificate?

Upon the 4th of June, 1892, I addressed a very long letter

to the Local Government Board in reference to a number of questions as to the Customs and Inland Revenue Acts, some of which are now of no interest, but in the letter these two material points were raised, which will be best understood by quoting them in extracts :—

* * * * *

"I would beg furthermore to submit to your Honourable Board that in the provisions of the Statute it is left in doubt whether it is the duty of the Medical Officers of Health to ascertain values and other points in connection with liability to Inhabited House Duty, and whether the certificate is to precede or to follow upon the question of liability and the claim for exemption.

* * * * *

"It will be observed that I have taken the view that Her Majesty's Commissioners of Inland Revenue are acquainted with the precedents and definitions of the class of houses intended to be included in the sections of the Act, and that until an owner has furnished the Medical Officer of Health with evidence that his house does, or will, come within the Act, or the Medical Officer has otherwise been furnished with such evidence, the Act does not contemplate that he shall examine and certify.

* * * * *

"Upon carefully reading the words of the section the requirements of the certificate appear more especially to relate to construction and fittings, and are couched in positive and not in negative terms, consequently every detail of a house under such a certificate receives the imprimatur of the Medical Officer of Health as being constructed and provided in a fit and proper manner, and as a desirable pattern for imitation. The experience of expert architects and surveyors tends to show that the effects of details in large buildings occasionally escape even their observation, and the ultimate effects upon health of many methods and forms of construction and fittings have not yet demonstrated themselves; in fact, sanitation is constantly advancing. Nevertheless, the Medical Officer of Health who grants a certificate may have quoted, possibly against him, every detail of construction to which he has certified; and how far my future opinions and recommendations might be paralysed by this course has given me cause for grave consideration.

"Your Honourable Board will recognise the wide margin between the minimum of sanitary construction enforceable under legislative enactments in old houses, whether occupied singly or by members of more than one family, and the maximum demanded by public opinion for new buildings, although not enforceable under existing enactments.

"I would beg to be directed by your Honourable Board as to the standard to be adopted in certifying, and to ask whether I am justified in declining to certify a house constructed or provided in whole or in detail, or in single instance, the reproduction of which in future new buildings I should repudiate."

* * * * *

To this letter I received the following reply:—

COPY 59265 C.
1892.

LOCAL GOVERNMENT BOARD,
WHITEHALL, S.W.

15th August, 1892.

SIR,

I am directed by the Local Government Board to advert to your letter with reference to the certificate required to be given by a Medical Officer of Health under the provisions of Section 26 (2) of the Customs and Inland Revenue Act, 1890, as amended by Section 4 (1) of the Customs and Inland Revenue Act, 1891, to enable the District Commissioners to discharge the assessment to Inhabited House Duty in cases coming within the Section.

The Board direct me to state that they have no jurisdiction to determine the question raised in your letter, but it seems to them that it is not incumbent on you to examine a house, with a view to ascertain whether you can give a certificate, unless you have evidence that the house comes within the Section.

The Board have no authority to give any directions as to the standard to be adopted in certifying houses under the Section, and you must act upon your own judgment in determining whether a certificate can properly be given in any particular case. The Board do not however consider that a certificate that a "house" affords suitable accommodation for each of the families or persons inhabiting it, and that due provision is made for their sanitary requirements, should be construed as meaning that the sanitary arrangements are perfect in every detail, according to the latest developments of sanitary science.

I am, Sir,
Your obedient Servant,
(Signed) S. B. PROVIS,
Assistant Secretary.

J. F. J. SYKES, Esq.,
Medical Officer of Health to the Vestry of the Parish of St. Pancras.

After receiving this letter I came still more definitely to the conclusion that a house should not be examined under the Customs and Inland Revenue Acts, 1890 and 1891, unless and until evidence is produced that the house comes within Section 26 (2) of the 1890 Act, or Section 4 of the 1891 Act, and that as I could not give a certificate in the words of the Act because they were not defined, it would be necessary to state definitely to what the certificate applied. Accordingly I drafted and adopted the following form of certificate, which is sent to the owner of the house, or his agent, or to the Surveyor of Taxes, as thought best.

It is, of course, the duty of the Surveyor of Buildings to see that the building conforms to the Building Acts and other similar provisions relating to inhabited houses, but there is nothing to prevent the Medical Officer of Health from ascer-

taining for himself whether the building so conforms, but it would be exceeding his province, and unwise, for him to certify to that effect.

Customs and Inland Revenue Acts.

53 & 54 Vic., cap. 8, sec. 26 (2), and 54 & 55 Vic., cap. 25, sec. 4,

Inhabited House Duty.

Certificate of Medical Officer of Health.

Having been furnished with evidence that the assessment to Inhabited House Duty of the house described below will be wholly or partly discharged by the Commissioners acting in the execution of the Acts relating to Inhabited House Duties, provided that a Certificate of the Medical Officer of Health be produced, and having been requested to furnish the said Certificate. I hereby certify that I have examined the house described below, and am of opinion that the house is so constructed as to afford suitable accommodation for each of the persons inhabiting it and that due provision is made for their sanitary requirements, these words being interpreted to mean that the house is so constructed:—

1.—That each of the persons inhabiting it is provided with at least four hundred cubic feet of air space.

2.—That each of the living or sleeping rooms is at least eight feet in height, and at least ninety-six square feet in area.

3.—That there is at least one draw-tap and sink, with a sufficient supply of water thereto, for every twelve occupants or less, on each floor.

4.—That there is at least one water-closet, properly supplied with water, for every twelve occupants or less, on each floor.

5.—That the drainage of the premises is in accordance with the Regulations recognised by this Authority.

6.—That accommodation for clothes-washing is provided, sufficient for the number of persons inhabiting the house.

Name and Situation of House ______________________

____

Name of Owner or Agent ______________________

Date ______________

____

Medical Officer of Health for the
District of St. Pancras.

As by the Customs and Inland Revenue Acts, 1890 and 1891, artizans' dwellings so well constructed and arranged as to be worthy of certificates may be exempted from the payment of inhabited house duty, in the case of future new artizans' dwellings, if the plans of drainage have not been previously submitted to and approved by the Medical Officer of Health, owners run the risk of not obtaining certificates.

A Medical Officer of Health may protect himself in the future against the attacks of the dissatisfied by officially requesting his Vestry or Board to add or attach such a paragraph as the preceding to the drainage or building form, in order to make it known before building.

In future new houses the following additional requirements may also be expected:—

That the house is provided, on each floor, with at least one sufficient space or lobby open to the air, accessible to and for the use of the occupants of the dwellings on each floor.

That the house is so constructed and arranged that perflation of the dwelling rooms be not obstructed.

That accommodation for bathing is provided sufficient for the number of persons inhabiting the house.

That there is an outer door or gate locked at night, or a resident caretaker.

The constructors of this class of buildings have, therefore, to consider whether they shall build them in self-contained dwellings with balconies or stair-cases open to the air, and so escape both the inhabited house duty and the certificate of the Medical Officer of Health; or whether they shall build them, whether self-contained or not, with inside staircases and become liable to inhabited house duty, and to the requirements of the Medical Officer of Health in order to obtain his certificate. In any case, it is quite evident that it is very simple to avoid the Acts, and to defeat the very object for which they were passed.

Before concluding it must be pointed out that inhabited house duty may be made a tenant's tax, and not a landlord's, and that in case of non-payment by the landlord, distraint may be made upon the tenant's goods. If an owner refuse to pay the duty and a levy be made upon the tenant, the tenant will doubtless plead that the rental of his dwelling house being under £20 a year, and being a separate and self-contained dwelling in a compound house, it should be assessed as a separate house for imperial taxes, the same as it is for local rates, and that therefore he should be exempt. Such a case has not yet arisen, but when it does arise it will be interesting to see how our judges and legislators will act.

Again, what would happen if, in inspecting a house for which the owner desired a certificate, one or more occupiers of the separate dwellings refused admission to the Medical Officer of Health or to the Sanitary Inspector? These officers would have no reason to suspect a nuisance, and they have no power of entry under the Customs and Inland Revenue Acts.

"*Infantile Mortality and its reduction, especially in regard to Measles and Diarrhœa,*" *by* JOSEPH PRIESTLEY, B.A., M.D., D.P.H., Medical Officer of Health, Lambeth.

(FELLOW.)

THE subject which the Council of the Sanitary Institute have asked me to bring before you to-day is one of an absorbing interest, and of the utmost importance to all Health Officers and others engaged in the study of practical Sanitary Science and Public Health; and whilst I cannot offer anything that is startlingly new, I trust that I may be able to put the matter briefly before you in such a way as to give rise to what, I hope, will prove a useful and profitable discussion.

The subject of Infantile Mortality is a wide one, but I am fortunately chiefly limited to its consideration in so far as it results from Measles and Diarrhœa. Taking the decennium 1881-90, there were registered in England and Wales 5,244,771 deaths at all ages from all causes, and of these deaths 1,259,860 (*i.e.* 24 °/$_{\circ}$) were amongst infants under one year of age. Analysing these 1,259,860 deaths more in detail, we find 25,366 were certified as due to measles and 120,943 to diarrhœal diseases (including diarrhœa, dysentery, gastro-intestinal catarrh, cholera, and choleraic diarrhœa), giving a total of 146,409 (*i.e.* 11·6 °/$_{\circ}$) due to the two diseases—measles and diarrhœa. Diarrhœal diseases caused more deaths amongst infants under one year of age than all the other zymotics together, whilst measles caused more deaths than any other one zymotic with the exception of whooping cough and diarrhœa. The total chief zymotics carried off 209,010 infants, respiratory and nervous diseases 456,461, phthisis, tubercular, and scrofulous diseases 79,055, violence 21,095, and other causes 494,239.

The waste of life, therefore, amongst infants under one year of age is enormous, and calls for serious consideration at our hands with a view to, if possible, lessening it.

It may be noted here in passing that infantile mortality from all causes (*i.e.* deaths of infants under one year of age) has on the whole *decreased* slightly during the decennium 1881-90, giving a rate of 142 per 1,000 births registered as compared with 149 during 1871-80, and 154 during 1861-70; in each decennium the male rate being slightly greater than the female. The infantile mortality from diarrhœal diseases has also *decreased* slightly during the three decennia 1861-70, 1871-80, 1881-90, whilst that from measles has *increased* slightly during the same

periods. The slight *decreases* in connection with infantile mortality as a whole, and that due to diarrhœal diseases, are satisfactory as far as they go, but are hardly *pari passu* with what one had hoped and expected from the concomitant sanitary improvements and improved methods of diagnosis that have taken place, not to mention the fact that the birth-rate has been decreasing since 1878, altering the age-constitution of the population and lessening the infantile mortality since then.

To impress upon you still further the enormity of the loss of life amongst infants from the two diseases—measles and diarrhœa, allow me to put the facts in another way, by treating each disease separately. Statistically considered (and expressing results in rates per million living at under one year of age), we find that in the case of measles:—

3,365 infants died during 1881-90, as compared with 2,767 and 2,737 during 1871-80 and 1861-7 respectively. At all ages the measles mortality, during 1881-90, was 440 per million living, consisting of 595 in Urban England (78 principal Towns), and 329 in Rural England, whilst the rates (under 5 years of age) varied in different Counties from a minimum 924 in Westmoreland, to a maximum 5,053 in Lancashire. Measles-deaths reach their *maximum* during the second year of life, and the disease is one which chiefly attacks children of tender years, and requires careful nursing and attention to prevent the after (dangerous) effects, though parents are apt to regard it as a trifling complaint, and one that it is necessary for their children to have, and that, therefore, the sooner they have it the better—an unfortunate line of argument as far as the children are concerned! In fact, this parental apathy with respect to the disease, together with the slightness of symptoms at times, is the cause of medical men, in a large percentage of cases, not even being called in or consulted, with the result that the patients are home-treated without proper and suitable precautions being taken to prevent the lung complications which are a source of great danger to life.

Measles, moreover, is highly infectious before the appearance of the typical rash, and its infectivity is certainly increased (or shall I rather say, the infection, which spreads so quickly under ordinary circumstances, does so much more rapidly) amongst persons in over-crowded, dirty, ill-ventilated, insanitary rooms or buildings, and as the disease is one of infancy or childhood, it soon becomes epidemic amongst the scholars of an over-crowded or ill-ventilated or insanitary school room or dormitory.

These few details in connection with the etiology of measles will be referred to later on, in dealing with suitable preventative measures.

In the case of diarrhœal diseases we find that 16,044 infants (per million living) died during 1881-90, as compared with 19,817 and 19,645 during 1871-80 and 1861-70 respectively. At all ages the diarrhœal mortality (excluding cholera) during 1881-90 was 659, consisting of 851 in Urban England and 520 in Rural England; whilst the rates varied in different Counties from *minima* 1,112 and 1,132 (under five years of age) in North Wales and Wiltshire (with birth-rates of 27·96 and 29·37), to *maxima* 6,461 and 7,281 in Lancashire and Leicestershire (with birth-rates of 34·45 and 33·78).

Diarrhœal deaths reach their maximum during the first year of life, and it is with this so-called infantile diarrhœa that we are dealing, but it must not be supposed that diarrhœa affects only, or principally, infants and children; on the contrary, it affects adults more than children, though it proves fatal chiefly in very young or very old people (where power of resistence or vitality is low). From a long series of observations taken in Leicester, it would appear to be proved that the diarrhœal incidence is greater amongst adults than amongst children or old people, although the mortality rate is practically restricted to the very old or the very young.

The Corporation of Leicester distributed gratuitously for a series of years (during the third quarters) diarrhœa medicine to all comers, with the result that of 36,925 persons reported to be suffering from diarrhœa,

	1,778	were under 1 year of age.
	3,196	were between 1 & 2 years.
	1,844	„ „ 2 & 3 „
	1,166	„ „ 3 & 4 „
	769	„ „ 4 & 5 „
i.e.	8,753	*or* 23·7 % were under 5 years of age.
	2,418	were between 5 & 10 years.
	4,404	„ „ 10 & 20 „
	18,255	„ „ 20 & 60 „
i.e.	25,077	*or* 69·9 % were between 5 & 60 years,
and	3,095	*or* 8·4 % were over 60 years of age.

This fact in the etiology must be remembered in connection with the wider spread of this disease amongst all classes and at all ages than would appear from the registration of fatal cases (chiefly amongst infants), which come before all Health Officers in the ordinary course of their work.

Leicester is, as you are aware, notorious for (amongst other things) its infantile diarrhœa, and a valuable mine of information lies buried in the different Reports of Medical Officers and others extending as far back as 1847. A perusal of these

Reports, and reference to notes made by myself when Medical Officer of Health for Leicester, show that this diarrhœa is probably a zymotic disease due to the entrance into the body, through air or food, of germs or their products which grow and become active only under certain conditions. Thus, in the diarrhœa area (low-lying and crowded) of Leicester, during July and August months, 2,000 to 7,000 germs per cubic metre of air were noted as compared with 60 to 900 in the high and less crowded parts of the Town. Micrococci, bacilli, and moulds of different forms (the majority of micro-organisms liquefying gelatine) were separated, but nothing specific or distinctive discovered. These germs increase enormously in artificial cultivation under warmth, moisture, absence of light and fresh air, and in the presence of dead organic matter (vegetable and animal), and the cultivations were found to be capable of reproducing diarrhœa in those who ingested them. Similar germs were discovered in the kidneys, spleen, mesenteric glands, and the ulcerations to be found in the small and large intestines (mucous membranes), of patients who had died of the disease, and whose bodies were examined within a few hours of death.

The disease is practically *endemic*, shewing itself only during the third quarter of the year (*i.e.* the months of July, August, and September), when the 4-foot earth thermometer registers 56° F. and over, and disappearing when that temperature is reached as the thermometer falls. This so-called *critical* temperature 56° F. in its *causal* relation to the onset of epidemic diarrhœa is a fact about which there can be little difference of opinion amongst those who have studied the subject, or who will take the trouble to examine the many meteorological data at their disposal. I personally made a series of registrations and observations, and my results tally *in toto* with those of other observers. What the changes are that take place in the subsoil, I cannot definitely state, but it is probable that they are of a putrefactive and bacterial nature, giving rise to the subsequent and consequent development of the special diarrhœal poison. This 4-foot earth temperature is more trustworthy (because less liable to marked variations) than that of the atmosphere or that in the interior of sewers, and must affect any germs that may be present from defective sewers or drains, leaky cesspits, foul accumulations, "tips" of any sort, &c., whilst the level of the subsoil water may be a factor for good or evil in so far as it affects the ground air.

I would mention here that infantile diarrhœa during the third quarter of the year, was not a conspicuous feature of Leicester's death statistics fifty years ago, and the same may be said of the mortality tables of London. Since that date the disease

has shewn itself more definitely and distinctly, and is presumably more prevalent, as shewn by its greater fatality in urban than in rural districts, and in large, than in small, Towns, pointing to an excrement-sodden earth or polluted subsoil, as being a necessary ground-work upon which the germs develop their powers under the influence of the 4-foot earth temperature of 56° F. Although Leicester suffers severely, other Towns do also to a greater or lesser degree, from the ravages of this disease. The disease attacks all—rich and poor, strong and old, but proves fatal only in the very young and the very old (under five years and over sixty); though it must be remembered that, when the disease does not prove fatal in the young, its after-effects are to be seen in atrophy, debility, and general weakness and ill-health. Indeed, it takes months and months (nay, years and years) to rally completely from a genuine attack of epidemic diarrhœa—at least in young patients. The true disease once seen in a child will not be readily forgotten—the rapidity of onset, the fever followed by algidity, the offensiveness of the vomit and alvine discharges, the withered, pinched, little-old-man appearance and depressed fontanelles, the intense thirst, the peevishness and restlessness with sharp cries followed by moanings, the exhaustion, prostration and final collapse, together with the tendency to rally on the 7th or 8th day, followed by relapse and death (with or without fits) in twelve to twenty-four hours—form a picture to be lastingly imprinted on the minds of those who see it. The average duration of the disease (when fatal) is nine days, varying from five to twelve, and multiple cases occur in houses sometimes during an epidemic, giving rise in some observers to the belief in the contagiousness of this disease.

It is clear that the diarrhœal poison will act most severely upon those who have a low vitality (constitutionally and congenitally, or as the result of previous attacks of other debilitating diseases or of old age), so that the young and old suffer fatally. The young may be debilitated from improper or artificial feeding, though on the question as to the fatal incidence of the disease on breast-fed as compared with bottle—or hand-fed children, there is diversity of opinion and certainly non-agreement of statistics, *e.g.* those of Liverpool and Leicester. So too the young may be debilitated from maternal neglect (whether such neglect arises from the fact of the mothers working in factories or workshops, or otherwise); from inherited weakness of one or both parents, or from the parents' early and improvident marriages; from unhealthy and insanitary surroundings (darkness, dirt, overcrowding, want of air circulation round houses, in streets, or through courts and alleys, impure air inside

houses, filth accumulations, such as cesspits, pails, privies, neglected dung pits, or sewer gas generally, &c.); from impure water or food supplies, and from smoke nuisances. Some of these conditions affect persons of all ages. All these may act as contributory causes, whilst the bearing upon the subject of insurance amongst newly-born children, illegitimacy, uncertified deaths, the misuse (or rather use at all) of infants' cordials and soothing mixtures, etc., must not be forgotten.

The diarrhœa-rate is influenced too by the topographical position and geological formation of different Places, *e.g.* a low-lying and water-logged position as opposed to a high elevation and a dry and thoroughly drained subsoil, and clay *versus* sand or gravel—low-lying situations and sand or gravel appearing to favour the growth of the diarrhœa germs or poison.

Contributory causes or excitants of Diarrhœa (in order of importance).

1. Meteorological conditions, *e.g.*, 4 ft. earth temperature over 56° F., low rainfall, humid atmosphere;

2. Topographical and geological conditions, *e.g.*, lowlying, flat and waterlogged positions, with a damp subsoil;

3. Polluted condition of soil, arising from defective sewers and drains, leaky cesspits and privies, "tips" or made-grounds, &c.;

4. Unhealthy, insanitary, and dirty surroundings with want of proper ventilation and light in and around houses, round courts and alleys, and streets, *e.g.*, emanations from foul and offensive accumulations such as middens, pig-styes, nightsoil pails and privies, cesspools, &c.; back-to-back houses, and over-crowding on area or otherwise; excessive smoke; sewer gas; &c.;

5. Tainted food and impure water, *e.g.*, milk often kept in underground rooms or in badly-ventilated places where it is exposed to emanations from the earth, under- or over-ripe fruit, or water highly charged with vegetable matter;

6. Improper or artificial feeding, maternal neglect arising from outdoor employment of mothers or otherwise, the use of cordials and soothing mixtures, early and improvident marriages, constitutional or acquired weakness of parents, and debility of children (congenital, or the result of previous illnesses, insanitation, &c.);

7. Illegitimacy, uncertified deaths, and infant life insurances.

So much for the etiology and the statistics of the two diseases, and now I come to deal with a most important branch

of the subject, viz.: preventive measures to be applied with a view to lessening, if possible, at least somewhat, this enormous mortality. And first let me state that, if there be any persons present who expect that I am going to offer them an easy and ready method of lessening this mortality, I am afraid that I shall have to disappoint them; for it must be admitted from the descriptions of the diseases that there are many factors that will have to be considered, and therefore many different lines of attacks tried, if we wish to be successful.

I propose to treat the two diseases separately.

First, as to Measles.—In connection with this disease, the *crux* is certainly the notification, as to whether or not measles ought to be added to the list of notifiable diseases. Where notification would be followed by the other preventive measures well known to Medical Officers of health, viz.: isolation of patients in hospitals, the keeping away from schools of children from infected houses, disinfection, quarantining of suspects, &c., there can be but little doubt that such a line of attack would be highly successful, if adequate means were at hand for carrying out such isolation in properly equipped and ample hospital accommodation, and, if it were possible to hear of all the cases. This is, however, only *theoretically* true, for, in the Metropolis at least, and I suspect the same applies to most large towns, hospital accommodation is not adequate, whilst the large cost of supplying extra hospitals is a subject not to be lightly thought of. I have pointed out too, in describing the disease, various difficulties that present themselves, *e.g.*, the tender ages of the patients (to which may be added the natural dislike of mothers to part with their offsprings at such an early period of their existence); the difficulties of diagnosing the disease in its pre-eruptive (and also contagious) stages; the great rapidity with which the disease spreads, and becomes epidemic; the parental apathy in connection with measles, and the fact that medical men are not called in or consulted at all in a large majority of the slighter cases; and the careful nursing and attention required to prevent the after (dangerous) effects arising from lung complications. All these facts render it imperative that the Health Officer should pause before committing his Authority to a line of action and to an expense, the good to accrue from which might not be commensurate. *Theoretically*, nothing could be simpler, but *practically* nothing could be more difficult, than adding Measles to the list of notifiable diseases under the Act, with a view to benefit resulting from such a course. This I would call "full" notification, and I offer no objection to it in a small Community with suitable and sufficient isolation accommodation and a sanitary staff to follow up the

cases with disinfection, quarantining of suspects, &c. I have no doubt but that, under such circumstances, the expense involved would be more than justified by the good results obtained; but under other circumstances, viz.: in a large Community, without suitable and sufficient hospital accommodation and the necessary Sanitary Staff to follow up the cases, the matter is a very different one, and I think what is wanted is some sort of "partial" notification as between the Health Departments and the School Authorities. Measles affects chiefly infants and young children, and is undoubtedly spread *directly* through the agency of schools, so that if we find the inmates of any school becoming strickened down with this disease in such increasing numbers as to interfere with the attendance, the greatest good will be derived from the closure of that particular school or the particular class involved—more especially as we know that this disease spreads rapidly amongst scholars in an overcrowded, ill-ventilated, or insanitary school. The quickest and easiest way to obtain the necessary information preparatory to closing a school is by this system of notification between the Head Teachers or Attendance Officers, and the Health Departments. The cost would be slight and the information exactly in the form best suited for the purpose. I speak from a practical experience at Leicester, where I furnished the School Attendance Officers of the Leicester School Board with forms on which they were to report to me measles, all cases of infectious disease, and also doubtful cases coming to their knowledge, the nature of the disease (when known) being obtained from the mother or person in charge, or Medical Attendant (if any).

The question of sanitation (in its widest sense), and the importance of educating mothers in the proper treatment of children, and the rising generation in the elementary principles of hygiene and practical sanitary science, are matters to be remembered in connection with Measles, but perhaps not to such an extent as in the case of Diarrhœa, as I hope to shew presently.

Second, as to Diarrhœa.—Preventative measures have been again and again discussed at Meetings like the present, and I merely give my own ideas on the subject now and leave them to be discussed. Amongst principles that ought to guide Sanitary Authorities in dealing with infantile diarrhœa, first and foremost I place (1) *Cleanliness in its widest sense—municipal, domestic, and otherwise.* Pure air, pure water, pure food should be the Sanitarian's goal, and the various methods of obtaining such his daily consideration. Let sewers and drains be looked to, and the speedy and complete removal of all refuse matters

insisted upon. Give sunlight and pure air to your houses, streets, courts and alleys, and to the people inhabiting them. Away with back-to-back houses, insanitary areas, damp and dilapidated dwellings, town "tips," privies, cesspools and pails; see to your cowhouses, milkshops, dairies, pigstyes, slaughter-houses, bakehouses, &c.; and above all secure, if you can, Parks and Open Spaces in your Towns that are rapidly growing and becoming filled with builder's bricks and mortar, and give your people as pure air and water and as much of them as possible. Provide baths and washouses, and counteract any natural deficiencies of sites in your Towns as far as possible by artificial means, *e.g.* lowering the level of subsoil water by efficient drainage, etc.

Next, I would suggest the all importance of the rising generation being taught the elementary principles of Hygiene and Domestic Sanitation, making such a subject compulsory in Schools, so that the next generation at least may be better prepared to bring up in a proper manner their children, and know how to tender the seedlings so that they may develop and grow into hardy plants and not dwindle and wither away.

Finally, in relation to diarrhœa, the subject of illegitimacy and the proper care of illegitimate children, the treatment of the question of uncertified deaths, and those of infant protection, and the infant insurance, call for attention by Parliament, who (at a not far distant date, I hope) will give us amended Infant Life Protection and Insurance Acts, a sensible Midwife's Registration Act, Medical Advisers to Coroners, and Special Investigators into all uncertified deaths, &c.

It will be seen that I do not lay too much stress upon out-door employment amongst mothers, artificial or improper feeding, maternal neglect, the misuse of cordials and soothing syrups, early and improvident marriages, as causes of diarrhœa amongst infants. I am free to admit that they act as contributory causes or excitants, but the *vera causa* of diarrhœa is to be found in a microbial origin, the germs growing under the action of heat in a polluted subsoil, and the remedy for which is to be found in the words "national cleanliness." More light and air, less dirt and death. As insanitary conditions lessen, the health of the people at all ages will increase, whilst the infant population (being born of stronger and more robust parents) will have an extra advantage in the race of life. Debility, weakness, and illhealth may finally disappear, and the Hygienic Millennium arrive.

CONGRESS AT LEEDS.

CONFERENCE OF MUNICIPAL AND COUNTY ENGINEERS.

The proceedings of the Conference commenced with an address by the President, THOMAS HEWSON, M.Inst.C.E., published in the Journal, Vol. XVIII., Part III.

"*The New 'Royal Baths' at Harrogate,*" *by* FRANK T. BAGGALLAY.

ABSTRACT.

SOME of the Harrogate mineral water springs are at considerable distances from the principal group, which is in the valley from a quarter to half a mile east of the railway station. The water appears to rise from fissures in a stratum of shale and consists of iron, saline, chalybeate, and sulphur waters; all of which are taken internally as medicine for various complaints, and the last is used also for baths and douches. One spring was discovered three hundred years ago; and "The Old Sulphur Well" seems to have been known in the seventeenth century. In 1770 an act of parliament ensured public access to the then known springs and gave some protection from excavations in the neighbourhood. The original buildings were small domed shelters over the wells, and there was no bathing establishment before 1832. In that year and 1835, respectively, two bath houses were erected which have been recently pulled down. The Improvement Commissioners, appointed in 1841, built the "Royal Pump Room" and two others, and the "Victoria Baths," as well as some reservoirs. Since Harrogate became a municipal borough, the corporation, besides other improvements, have purchased all the principal springs previously in private hands, have built improved reservoirs and have devoted great attention to preserving the purity of the waters in several ways. They have also erected the "Royal Baths," equipped with all modern appliances and conveniences, with the intention of making it the foremost establishment of its kind. Some delays which occurred before this building was commenced were used to introduce improvements in the plans; particularly, a much larger number of dressing rooms was provided in connection with the douches and needle baths. As many frequenters of the building will be invalids, all the accommodation will be on one

level and there are no steps except at the entrances. The bath rooms are in pairs on the outside with the hot towel closets, attendant's rooms, lavatories, and so on between; and the dressing rooms are inside them next the corridors. All bath rooms for apparatus that produce much vapour have windows on two sides, and smooth vaulted ceilings to prevent drips from condensation. Each room has a separate set of service tanks giving a regulated head of water, and a thermometer is fixed in the joint service by which to regulate the temperature. In the two main departments there are 172 bath and dressing rooms, and the whole establishment will use 10,000 gallons an hour of hot water alone. The central hall is fitted as a pump-room. The Turkish bath accommodates about twenty persons and is luxuriously fitted; and there are also "Inhalation," "Pulverization," and Massage rooms. The basement is occupied by a steam laundry, boilers, machinery, attendants, mess rooms, and so on.

"*The Sanitary Aspects of Wood Pavements*," *by* CHAS. MASON, Assoc.M.Inst.C.E.

(FELLOW.)

THE title of this paper has been chosen by the author mainly with the view of eliciting a discussion upon a subject, which, in his opinion, requires more ventilation from those competent to form an opinion than has been accorded in the past. It is the author's firm opinion that most of the adverse criticism bestowed upon wood as a paving material is due to careless and improper methods of laying and subsequent maintenance rather than to the material itself. In the author's opinion, wood, if properly selected and treated and thoroughly well laid has advantages which should favour a continuance of its adoption as a carriage way pavement until some better substitute has been discovered.

In comparing different materials for street pavements asphalte is undoubtedly the most sanitary of all, but its general adoption on other than comparatively level roads is practically prohibited until horse haulage becomes a thing of the past.

It is not for the author here to give the history and development of wood pavements, a brief reference, however, to the different kinds of wood employed, their treatment and method of laying is necessary to enable us to grasp the sanitary conditions of such pavements.

The wood now employed is generally distinguished under the

titles of "hard" and "soft." The former embracing the hard woods from Australia and other places at the antipodes mostly of the eucalyptus family; the "soft" wood now generally in use being red or yellow pine from north Europe. Hard woods are generally laid in their natural state, that is, not subjected to any preservative, while the soft woods are now seldom laid unless previously treated with creosote or other preservative.

An essential qualification for a good pavement is a cement concrete foundation, floated over and formed to a proper contour to receive the wood blocks which must be laid directly thereon with necessary falls longitudinally in the channels towards the gullies for surface drainage. The life of a wood pavement varies from five to twelve years, according to the amount of traffic, quality of wood, and method of laying.

It is the author's object to shew that the method of laying and maintaining wood pavements, coupled with the fact that the renewals are not sufficiently frequent, is mainly the cause of complaints as to the insanitary condition of wood pavements; of course excepting a faulty system of scavenging which can easily be remedied.

The author intended taking samples of wood pavements that had been laid for a number of years in London, and analysing the blocks and their jointing materials to shew the quantity of matter injurious to health contained in say a square yard of pavement; this, however, has not been done, as the results would be misleading, so much depending upon the system of scavenging, contour of roadway, and other facts that would in the author's opinion render any statistics unreliable.

Experience as to scavenging, method of paving, street watering, repairs, and other matters incidental thereto are far more important in determining the conditions of wood pavements; the author therefore from an experience of seven years in the construction and maintenance of wood pavements in London has arrived at the following conclusion:

Wood pavements are condemned on sanitary grounds because:—

1. Too little attention has been given in the past to the contour of the road to allow for a natural fall to the gullies.

2. The wood used has in many cases not been carefully selected, and properly treated with a preservative.

3. The expansion joint in each channel is allowed to become a source of nuisance.

4. Repairs have not been carefully executed, and renewals have not been made at frequent intervals.

5. An inefficient system of scavenging has been allowed to exist.

Taking these seriatim:

(1.) The faulty contour of the carriage-way is due in many cases to the original foundation having been laid without due consideration as to the falls. This foundation *is* and should always be *treated as* the roadway itself, the wood being merely a covering for convenience. In cases where this foundation is found to require reforming, expense should not be spared in chipping over and refloating when the wood is "up" for renewals. It is, I regret to say, more the rule than the exception upon a tolerably level street paved with wood to see the channels so arranged that the water will not flow naturally to the gullies.

(2.) The wood should be carefully selected, free from sap and close and even-grained; [it is not necessary in paving works to have "thoroughly well-seasoned" wood], and the soft woods should be treated with creosote or other preservative. The author has used satisfactorily wood impregnated with creosote (10 lbs. to the cubic foot) and also wood treated with "Carbolineum Avenarius" (15 gallons to a thousand 9 in. × 3 in. × 5in. blocks), and tests of the absorption of each of these compared with a plain block (yellow deal) have been made with the following results:

Six blocks, measuring 3 in. × 9 in. × 5 in., immersed in water for twenty-four hours:

	Weight before.	Weight after.
Plain blocks... ...	16 lbs. ...	18 lbs.
Creosoted blocks ...	20½ „ ...	21 „
Carbolized blocks ...	18 „ ...	19½ „

These statistics prove the wood to be less susceptible to absorption after treatment than before, the advantage being in favour of creosote. Creosote however, having a strong smell which is often, the author regrets to say, objected to by adjoining occupiers, favours the introduction of carbolized blocks in special places.

(3.) The expansion joint in the channel of a wood-paved road is from a sanitary point of view a great objection, and is the means of road detritus and other matter being retained therein, and finding its way beneath the wood pavement. The author has frequently found from this cause large quantities of filthy black mud, &c., beneath the channels and surrounding the gullies, which is a considerable source of nuisance.

(4.) The greatest care is necessary in carrying out repairs to gas, water, and other excavations; the foundation and pavement over should be done, if possible, in a *more* skilful manner than the laying of the original pavement, and all defects in the wood likely to cause depressions for the reception of deleterious matter should also have immediate repair.

The parsimonious manner in which public authorities often allow wood pavements to remain longer than their proper "life" is undoubtedly the chief cause of complaints as to the condition of such pavements, and on no account should an uneven and worn pavement be allowed to remain in what must naturally be an insanitary condition.

(5.) Inefficient scavenging has only to be mentioned to receive the just condemnation it merits. Any sanitary authority who curtails the scavenging expenses to the detriment of efficient work ought to be immediately superseded by some more capable system of local government, for the root of the whole matter lies in a perfect system of scavenging, which can only be properly carried out when the necessary funds are allowed, and every official should have a free hand in this, in order to carry out the work with credit to himself and the public whom he serves.

The hard woods mostly used for street paving works are those known as "Karri" and "Jarrah" from Western Australia.

These woods are generally laid close jointed, and grouted with pitch and tar, and form an excellent sanitary pavement, their liability to contraction however, has proved a drawback as the spaces left between the blocks when contraction takes place, become filled with horse dung and road detritus which it is impossible to get out. It is to be hoped this wood will soon be supplied in such a condition that this, its only fault from a sanitary point of view, will soon be a thing of the past.

The foregoing remarks may be summarized by stating the essentials towards a satisfactory wood pavement :

1. A properly constructed roadway.
2. Careful maintenance and frequent renewals.
3. Good scavenging.

Wood is in the Author's opinion suited for town pavements, on account of its being less noisy and less slippery than any other kind of pavement suitable for heavy traffic, and in order to overcome the objections before mentioned, all soft woods should be properly creosoted (in vaccuum and not simply dipped) the blocks laid "close jointed" to a proper contour both transversely and longitudinally, and grouted with bituminous composition. This method is adopted by the Author, and it has been found that the blocks do not when thus laid expand more than is requisite to bind the whole pavement together, and those interested in the subject are referred to that portion of the Strand, between Trafalgar Square and Charing Cross Station, which has now been in use for four years and washed daily without any material defects, although subject to an enormous daily traffic.

"*Notes on some of the dangers and difficulties of a combined system of drainage, that is where more than one house is drained into a common conduit*," *by* BUSHELL ANNINGSON, M.A., M.D.

(FELLOW.)

ABSTRACT.

THE Author pointed out in regard to the disadvantages of combined systems of drainage that the definitions of the terms "drains and sewers" of the Public Health Act, 1875, have, by throwing the responsibility of the maintenance of such systems upon the Local Authority, led to serious drainage difficulties in regard to the repair of defects in old parts of town communities, and in the development of building estates in newer parts of Towns, and in the measures necessary for the diversion of sewage from the natural watercourses under the Rivers Pollution Prevention Act; a result due mainly to the natural reluctance of Local Authorities to charge upon the public Revenue, moneys for what in fact is an improvement of private property and a relief to owners of unhealthy houses.

In regard to the danger of such systems of combined drainage, the author pointed out that in practice these combined systems, while being treated legally as sewers, were physically treated merely as drains and that the several contributory houses were allowed to be connected thereto without interceptors and ventilating shafts, as would be insisted upon in respect of a recognised public sewer. He gave instances in which the poison of typhoid fever had been conveyed from one household to others adjacent along the line of the common conduit, and he suggested that under the existing legal difficulties the best remedy would seem to be to treat the common conduits as real branch sewers and disconnect each contributory house by an air interceptor and ventilating shaft of its own; and further in newly-developed building estates, power should be acquired to insist upon a back alley between two parallel rows of houses, as is required under some Local Acts. The only objection to such a scheme being that the distance between the back of the premises and the back alley, involves, in order to obtain adequate fall, a depth of sewer which might not readily conform to the level of the public sewer already existing.

CONGRESS AT LEEDS.

CONFERENCE OF SANITARY INSPECTORS.

The proceedings of the Conference commenced with an address by the President, PETER FYFE, F.R.S.Edin., published in the Journal, Vol. XVIII., Part III.

"*Our Seamen's Dwellings Afloat*," *by* W. H. CRANE. (ASSOCIATE.)

ABSTRACT.

THE importance of this subject can hardly be realised by landsmen. They cannot imagine the state in which seamen in the past existed, and are existing in some few instances to-day, through occupying insanitary forecastles.

The sailing ships of to-day differ from what they were in the past: our seamen dwelt in forecastles which were a disgrace to the ship-owner; the living spaces were encumbered with the windlass, chain cables, and flooded with water, which rushed through the hawse pipe every time the vessel plunged into the sea, thus for the time making them unfit for habitation. Still some of this class exist. They are the minority—a change has taken place for the better, and deck houses, with proper means of light and ventilation, have been substituted for the ill-ventilated, wretched forecastles of years ago.

Coasting vessels with defective lighting and ventilation, and quarters rendered more miserable by neglect of disheartened crews through being compelled to live in such places, are still found.

In this class, however, a change for the better has taken place.

The modern master and shipowner, whose attention being called to the evil does not remedy it, is the exception, not the rule.

The legal cubic space, 72 feet, is too small.

The Hull and Goole Port Sanitary Authority have had the following matters directly under their consideration—

(1) Extension of the cubic space.
(2) The covering in of all iron work.
(3) The provision of bath and lavatory accommodation, so essential for health and cleanliness.

Vessels with lower forecastles are still met with. They require special attention. The men's quarters, which are badly lighted, are reached by narrow ladders. The foul smelling lamp and defective drain pipe (causing water to stand under the bunk) do not add to the men's comfort.

Top gallant forecastles for light and ventilation are an improvement.

To remedy defects in ships, first, it should be seen that the bunks are fixed one foot or more from the sides of the vessel; secondly, that all iron work is sheathed to obviate sweating, and thus preventing cold and rheumatism amongst the men. Wood decks should be laid two-and-a-half inches thick, and caulked.

Water-closets, when they adjoin any crew space, should be separated by double bulkheads, and ventilated efficiently.

Separate lavatory accommodation should be provided for the crew. This is obvious.

The paint work should always be of a light colour, making surroundings much more cheerful.

The prevailing custom on the large liners of inspecting the men's quarters should be made compulsory on all vessels. It would add considerably to comfort.

On every vessel, for purposes of isolation, there should be a spare berth, clear of the crew, to be used only in case of sickness breaking out. Patients could then be at once isolated. It would certainly check the spread of disease.

From a long experience as an Inspector I am driven to the conclusion that the real remedy for the defects that are met with to-day could be largely remedied, if by concerted action the Port Sanitary authorities resolved that there should be an inspection of the building of all vessels in course of construction similar to that made by urban sanitary authorities to-day in regard to houses.

"*Scottish Sanitary Jurisprudence,*" *by* JOHN LINDSAY, Interim Clerk to the Corporation of the City of Glasgow, Police Department.

UNDER the title of this paper I desire to restrict myself, and to direct your attention for the brief time fixed by regulation, to three sets of Acts of Parliament which relate to what may be described as Sanitary or Public Health matters. These Acts are

1. The Public Health Acts;
2. The Food and Drugs Acts; and
3. The Margarine Acts.

As regards the principal *Public Health (Scotland) Act* of 1867, you all know that that Statute under which Local Authorities have wrought for the last thirty years will cease having effect at the close of 1897, and that the new Public Health Act of this year (passed in the 60th and 61st years of Queen Victoria) will come into force.

In such a state of matters it is hardly necessary to discuss the defects and deficiencies which may have been discovered in the Act which has now nearly run its course; and it is somewhat premature, and therefore unsafe, to predict how far the new Act will accomplish the purposes which it is expected to do.

It is, however, satisfactory to know that, from the various views put before the Secretary for Scotland and the Lord Advocate, as well as before many Scottish Members of Parliament and Parliament itself, by members of Local Authorities throughout the country, and the officials who have been charged with the execution of the 1867 Act, considerable public good may reasonably be expected to result from the extended and increased powers granted by Parliament to local bodies for the prevention of disease and the greater security of public health.

To a very great extent the extended powers in the new Act have been taken from the London Public Health Act, 1891, and (although I am one of the representatives of the City of Glasgow, I do not hesitate to say) taken also from the Glasgow Police (Amendment) Act, 1890—locally known, after the late eloquent and enthusiastic Convener of the Health Committee of Glasgow, as Bailie Crawford's Sanitary Act.

The representatives from Glasgow, however, were unable to convince those in charge of the Bill when it was passing through Parliament to go as far as those representatives wished, but, at the same time, I think this opportunity should be taken advantage of for putting before you in a brief manner some of the powers that the Local Authority of Glasgow

possess, and which are not in the general Public Health Act, in the hope that, for the public good throughout the country, Local Authorities of the more populous burghs may endeavour to get similar local powers for themselves to deal with those subjects.

In Glasgow, when the Sanitary Inspector has reasonable grounds for believing that the drains connected with a house or building are defective so as to cause risk to health he may, in the case of tenement houses, after twenty-four hours' notice, apply the smoke or other test to such drains for the purpose of discovering the defect. If an owner or occupier refuses to allow such tests to be made, or to give all reasonable facilities for making such tests, he is liable to a penalty not exceeding forty shillings. If the drains be found defective the owner of the premises is bound immediately, on an order to that effect being given by the Local Authority, to carry out all necessary operations for removing defects of structure, or doing such acts as may be requisite to prevent risk to health. If the owner fails to comply with such order, the Local Authority may execute the work and recover the expense thereof as damages from the owner. This power comes in lieu of the old familiar process under the 1867 Act, which is continued in the 1897 Act, of presenting a petition to the Sheriff, and after proof or remit getting an order from him with a right of appeal in certain cases to higher Courts. When the power given is exercised with discretion and good sense it ensures expedition in the removal of what may be or become a dangerous nuisance: and comparatively few cases, not more I should say than half-a-dozen, have occurred where the Sanitary Inspector, our Chairman of to-day (Mr. Peter Fyfe), has had to do the work himself and afterwards sue through the Local Authority for the expenses incurred.

Again, when water to be used for drinking purposes or for the preparation of human food is discovered to be supplied from any cistern which is so placed or constructed as to be exposed to contamination, the owner is by the Local Authority called on to forthwith remedy the state of matters, and on his failing to do so he is liable to a penalty not exceeding forty shillings and to a daily penalty of ten shillings.

Again, when required by the Local Authority, the owner of every house within the city into which water has not already been introduced is bound to provide an ample supply of water convenient to such house to the satisfaction of the Local Authority. He is also bound to fit up in some window recess, or other well-lighted and ventilated place, a sink, with a sufficient waste-pipe disconnected from the sewer. And again,

when required, the owner of houses which consist of not more than two apartments is bound to provide to the satisfaction of the Local Authority adequate and suitable water-closet or other latrine accommodation as may be so required, convenient to such houses. Again, the owner of a house which consists of more than two apartments is bound to provide, also to the satisfaction of the Local Authority, such adequate and suitable water-closet accommodation as may be deemed advisable by them, and in all cases with proper soil pipes. Further, all such sinks, waste-pipes, soil-pipes, and water-closets are to be supplied with water, and to be trapped and ventilated so as to prevent any leakage or effluvium therefrom; and all sinks, waste-pipes, soil-pipes, and water-closets already existing, or which may be fitted up under those powers, must be kept in complete repair by the owner. Failure on the part of the owner to conform to those provisions, or to make the necessary alterations, renders him liable to a penalty of £5 and to a daily penalty of forty shillings.

Again, if the Medical Officer, the Sanitary Inspector, and the Master of Works shall certify in writing to the Local Authority that any house or building or part thereof is unfit for human habitation, the Local Authority may by their order declare that the same is not fit for human habitation, and it is unlawful after a date specified in such order for the same to be inhabited, under penalties on the owner and occupier thereof. Before pronouncing any such order the Local Authority require the owner to show cause against the Certificate and are bound to give him an opportunity of being heard before them, and, if he appears, to hear him and such evidence as he may adduce. Power is given to the Local Authority at any time thereafter, on being satisfied that the condemned houses have been rendered fit for human habitation, to revoke or vary the order; and for the purposes of carrying out the provisions just referred to, the Local Authority may act by a Committee whose quorum is not less than five. Any person aggrieved by an order may within five days from the date thereof appeal to the Sheriff, and the Sheriff shall with all reasonable dispatch, and, if practicable, within seven days after the presentation of the Appeal, dispose of the same, and his decision is declared to be final, and not subject to review; but the confirmation of any such order by the Sheriff does not prevent the Local Authority, if they are satisfied that the houses have been rendered fit for human habitation, from revoking or varying such order. Here I desire to state that since the coming into force of this 1890 Act till 21st December last, 409 houses have been closed under those powers as unfit for human habitation. Of

those at the end of the year 264 remained closed, 55 were converted into workshops, stores, &c., 11 were taken down and rebuilt, 16 were taken down for business purposes, 50 were cleared away, 9 were altered and re-opened as dwelling-houses, and 4 were made into water-closets. During this year 132 houses have been closed as uninhabitable, and of these 1 has been re-opened.

I now desire to direct your attention to *The Food and Drugs Acts of* 1875 and 1879, and to *The Margarine Act of* 1887, and I propose to put before you several suggested amendments of these Acts which have commended themselves to the Local Authority of Glasgow and to their officials as tending towards the public good. I ask your special attention to those suggestions because of this, that we may expect on a very early date, if not indeed in the next Session of Parliament, that new Acts dealing with those subjects will be introduced into Parliament, and if the suggestions made commend themselves to you, it is very desirable that you should put them before your respective Authorities with the view of getting your Authorities to submit them to Parliament through their representatives there.

As regards the *Food and Drugs Act of* 1875, *Section* 2 deals with interpretation, and the suggestion made to you is that the word "food" should be broadened in its definition, with the view of including all condiments, flavourings, colourings, preservatives, or other substances introduced to, or used along with, human food, that is to say, to every article used for admixture with food, or drink of man.

Section 3 deals with the "Prohibition of the mixing of injurious ingredients, and of selling the same." What is submitted for your consideration as regards this Section is this, that it should be amended by deleting the words therein "so as to render the article injurious to health," and substituting in lieu thereof, the following or similar words, namely, "which is of a poisonous nature, or which may render the article dangerous or injurious to the health of any person using the same, or which is known to be dangerous or injurious to health." It is also suggested that the onus of proving that the added substance is not dangerous or injurious to health should rest upon the defendant, that is to say, on the person who is proved to have introduced it to the article of food or drug, or to have sold it so introduced.

It is further suggested for your consideration the advisability of distinctly specifying certain ingredients which are of an admittedly poisonous or dangerous or injurious nature, as absolutely forbidden, and, in that case, the analyst's certificate of the

presence of such ingredients, or any of them, would be sufficient to establish the charge of adulteration. As an example of this, reference may be made to a law of the German Empire, passed 5th July, 1887, to this effect:—"Colours detrimental to health are not allowed to be used in the preparing of food, and of other articles for domestic use intended for sale. Colours injurious to health, within the meaning of this Section, are those coloured substances and coloured preparations which contain antimony, arsenic, barytes, lead, cadmium, chromium, copper, mercury, uranium, zinc, tin, gamboge, coraline, picric acid."

It is suggested, too, that the best way to determine what ingredients should be included in such a specific enactment would be by the French method of nominating a commission of acknowledged experts to report upon the same. This could be done, as in France, from time to time,—the Food and Drugs Act providing for the addition to the list of proscribed ingredients of those new chemicals which might be found present in human food without warning.

At present such questions are in this country fought at enormous expense, and, as regards the interests of the consumer, with great disadvantage. Whatever the result, it settles nothing, excepting possibly in the particular locality and before the same Magistrate. In other parts of the country exactly the same question may be raised with an entirely different result, whereas, by the method of commission now suggested, a purely scientific enquiry would be held, at which the interests of the consumer would receive fair consideration, and there would be no possibility of injustice to any individual, shop-keeper or manufacturer, because the result would apply equally over the whole country.

Section 4 of the above Act relates to the "Prohibition of the mixing of drugs with injurious ingredients, and of selling the same." As regards that Section it is submitted that an addition should be made thereto forbidding the sale of drugs which, not being made from the natural source, contain ingredients which are injurious or prejudicial to patients to whom the drugs might be administered, and it is further urged that the British Pharmacopœia should be legalised as the standard for all drugs. At present there is no standard for drugs, and, therefore, it is well nigh impossible to say, far less prove, that drugs supplied are not of the nature, substance, and quality demanded, as few, if any, know what they are legally entitled to get.

Section 6, which, as you know, is the principal section of the Act, relates to the "Prohibition of the sale of articles of ood and,of drugs not of the proper nature, substance and quality."

On this important point it is suggested that Sub-section 1 of this Section should be amended on the lines suggested in the amendment submitted as regards Section 3, and be made to read somewhat as follows—"where any matter or ingredient, which is not of a poisonous nature, and not known, or not likely to be dangerous or injurious to health, has been added to the food or drug," &c., &c. Sub-section 2 should be deleted, because it seems surely to be wrong to provide, as at present, that, while licensed and qualified dispensers of medicines are subject to the provisions of the Act, unqualified and irresponsible compounders are excepted. In my view it would be only right that proprietary medicines should require to have a label on each packet clearly and distinctly stating their composition. A provision should further be made prohibiting the addition of any inert, insoluble, or indigestible substance, or ingredient, to any articles of food, unless the vendor in these cases also labels the article in such a manner as to clearly reveal to the purchaser the preparation and character of the inert, insoluble, or indigestible ingredient; and where the adulterant exceeds 50 per cent. of the total quantity of the article, such as it often does in coffee mixed with chicory, it should be made illegal to sell the compound by the name of the article adulterated. This is provided for in America in the case of cheese adulterated with oleo-margarine, put in to take the place of the natural fat. The sale of such cheese is prohibited except under the name of "Imitation Cheese." Under this section very many prosecutions take place regarding the sale of milk, which, so far as the supply of a city is concerned, is most probably and generally mixed or average milk. The fat of average sweet milk never falls under 3 per cent. of natural fat; yet, because it has been known that some half-starved cow has been found to produce milk as low in fat as 1·98 per cent., charges of adulteration, where the sample showed a percentage of fat considerably below the standard (2·75 per cent.) of Somerset House, have been dismissed. Thus, for want of a legalised standard, farmers and dairymen may, under these decisions, take away 33 per cent. of the natural fat of average milk, and sell with impunity what remains as sweet milk. In my humble opinion some method ought certainly to be adopted of getting rid of the absurd contention that, because some cow, in some condition or other of health, or of feeding or otherwise, has been known to produce some white fluid, which is called milk, therefore that milk must be taken as the standard of sweet milk in all cases throughout the country. In view, therefore, of this, and of the fact that very large quantities of milk are thus impoverished, it is suggested that the Legislature should at once

standardise sweet milk, and provide a clause specially dealing with this all-important food, especially in the cases of infants and of invalids. A standard should also be fixed in the case of cream, and the sale thereof, when under that standard, should not be allowed as "Cream." On these points, as on that of possible injury to health under Section 3, the question of a standard is eminently one to be considered by a commission of experts, but, in any case, the purveyor of such an abnormal article ought to be compelled to prove that it is the production of a single cow, to be produced for independent investigation, as the quality and purity of the supply of towns very closely affect the health of the infant population, and the mortality of infants in towns is always greatest in the industrial quarters, and it is there that the adulterated milk is purveyed. I would point out that in the City of Berlin, by Municipal Ordinance of the 6th of July, 1887, the sale of milk is prohibited which "contains any foreign matter, especially any so-called preservative of whatever kind." Since the date of the passing of the Food and Drugs Acts, the use of so-called food preservatives has been so much extended as to create a new phase of adulteration, which renders some amendment extremely necessary. The article of food often does receive repeated doses of objectionable ingredients, as preservatives, when passing through different hands. Thus milk may receive a dose of boracic acid, intended as a preservative, from the farmer, a second dose may be added by the dairy keeper, and a third by the nurse or mother to the child; and thus the infant receives a triple dose. It is also well established that the use of boracic acid, salicylic acid, and other objectionable ingredients, is extremely common, and is becoming more so. Out of twenty-four samples recently taken at random by one of the public analysts of Glasgow, ten contained objectionable substances. These samples, relating to aerated waters, lager beer, and coffee extracts, all had salicylic acid; aerated waters had lead; fish, milk, and butter had boracic acid.

Section 7 deals with "Provision for the sale of compounded articles of food and compounded drugs." It is suggested that compound foods, such as invalids' and babies' foods, meat extracts, and so-called egg powders, should also have legibly marked on their coverings their composition, as otherwise this Section is of little service to the public, who purchase in ignorance of the contents of these parcels of compound foods, being mainly induced to do so through advertisements. At present, unless these foods contain injurious admixtures, the vendors may sell what they choose under the names adopted, and for the same reason, as already stated, patent or proprietary medicines should be placed in the same category, in order to prevent

fraud. In asking for some particular soothing syrup or for certain pills, the public get what they demand, but at present they demand in complete ignorance of what they ought to get.

Section 8, which has for its rubric "Protection from offences by giving of label," deals with harmless adulteration of simple or natural food, but there has been some dubiety as to the meaning of the words "a label distinctly and legibly written or printed." It is urged that the section should be amended to the effect of specifying the size of the letters which must be used in all such intimations, as is done in the case of the sale of margarine, under Section 6 of the Margarine Act of 1887. It is also suggested that words like the following should be added to the end of that section, "the said writing or print to show the nature and proportional quantity of the matter or ingredient added, and the letters on label intimating the same to be each not less than one-eighth of an inch square."

Section 9 relates to the "Prohibition of the abstraction of any part of an article of food before sale, and selling without notice." It is suggested that in this Section it should be provided that it shall be no good defence to aver or prove in a case where extraction of cream is averred that the cream is likely to have been given to earlier purchasers, otherwise there may be prejudice or fraud on late purchasers.

Section 13 has for its rubric "Officer named to obtain a sample of food or drug to submit to analyst." This Section should be amended to the effect of making clear that female sanitary inspectors should be regarded as deputies of the officers appointed under the Section, in respect that the male inspectors become known, and some milk vendors habitually pour some cream into the sample of milk before handing it to them, and others keep what is known as "the Inspector's can."

Section 25 has for its rubric "Defendant to be discharged if he proves that he bought the article in the same state as sold, and with a warranty. No costs except on issues proved against him." This Section deals with the question of warranty, and it is suggested that it should be amended to the effect of clearing up the disputed point as to what really constitutes a written warranty under the Act. It is suggested that a schedule should be attached to the Act giving the precise form of the warranty required. The procuring of samples of food and drugs from retailers, which may have been adulterated by the wholesale dealer, or manufacturer, before they reached such retailers, is the principal grievance which Sir Charles Cameron sought to meet in his recent Bill. My opinion then was, and still is, that to give effect to that proposal would utterly destroy the whole intention and usefulness of these Acts. It may, in certain cases, be

true that retailers receive adulterated articles from a wholesale house or manufacturer, and by taking no precautions to obtain a warranty with these, or discover for themselves the constituents of the articles, are punished for selling them. In this respect they are in the same position as the retailer of milk who receives this commodity from the farmer by railway, and in whose interest Section 3 of the amending Act of 1879 was passed. This Section works well where the honesty and vigilance of the milk purveyor are exercised in conveying the necessary information to the Inspector, and, in my view, a wholesome check would be put upon agents, wholesale houses, and manufacturers, if the provisions of this section of the amending Act were extended to all articles of food and drugs; and sufficient protection would be afforded to retailers who had any cause to suspect the purity of goods invoiced to him, were the Inspectors empowered to procure samples from goods in course of delivery, and to this extent assistance might be given to the retailer; but it would be destructive of the Act to take all responsibility off the shoulders of the retailer in the manner proposed in the recent Bill, or by accepting an invoice as equivalent to a warranty.

Section 27 deals with "Punishment for forging certificate or warranty; for wilful misapplication of warranty; for false warranty; and for false label." This Section would, in any case, require to be amended, so as to define and specify the procedure competent to secure the conviction and punishment of a wholesale firm, or manufacturer having his *locus* in a distant part of any of the three kingdoms—in other words, should provide how an English or an Irish firm is to be made amenable to the Scotch courts, and *vice versa*.

As regards the *Amending Act of* 1879, the only Section to which I would direct your attention is the third, whose rubric is "Officer, inspector, or constable may obtain a sample of milk at the place of delivery to submit to analyst." The observation I have to submit thereon is that the provisions of that Section, at present applicable only to milk dealers and farmers, should be extended to all wholesale merchants and manufacturers sending food or drugs to retailers.

As regards *The Margarine Act*, I would direct your attention to Section 6 thereof; whose rubric is "Marking of Cases." I would suggest that this Section should be amended to the effect of providing that the paper wrapper in which the margarine is to be delivered shall have printed thereon, as therein required, the word "margarine" alone. It has been held by our High Court of Justiciary that if the word "margarine" was printed, as required by that Section, on the wrapper,

there was nothing to prevent the retailer printing the names of a dozen other articles of food on the same wrapper, although the intention of the Act was that by printing the word "margarine" it was to be an intimation to the purchaser that what he was receiving was margarine. Thus, in the case in question, it might have been any one of the dozen enumerated articles, and one of the Judges (Lord Young), who dissented from, or at least demurred to, the decision, said that it might mean that the dealer would have conformed to the Act if, by having regard to the size of the print of the word "margarine," he made the intimation read "This is not margarine." It is also suggested, as regards this Section, that a clause should be inserted dispensing with the necessity of analysis where the contravention is simply neglecting to label the kit or parcel of margarine, when it is admitted by the seller at the time that the article is margarine. It is provided in clause 9 of Section 33 of the Sale of Food and Drugs Act 1875, which regulates the procedure under the Margarine Act, that "every penalty may be recovered at the instance of the person who caused the analysis to be made." Thus an analysis is necessary to found a prosecution by an Inspector, and hence, in the great majority of cases under the Margarine Act, unnecessary expenses are incurred by analysis which have to be paid by the defenders, and this has been the subject of comment on several occasions by Sheriffs and other Judges.

The foregoing views I submit to you as tending, if given effect to, to defeat the aims and objects of the unscrupulous and dishonest, and at the same time, to protect the legitimate interests of the consumers—the public. They are not put before you in any captious or haphazard way, but as the result of an every day experience of the working of the Acts, which has disclosed wherein the weakness and defects lie. Having put the suggestions before you my duty at this Congress ends; yours, however, now begins. If the suggestions made, or any of them, commend themselves to you, adopt them and do what you can to have legislative effect given thereto.

"*Smoke Nuisances and their Abatement,*" *by* JOHN SUMNER, Chief Sanitary Inspector, Wigan.

(ASSOCIATE.)

ABSTRACT.

NUISANCES arising from dense black smoke issuing from the chimney stacks of works are very common, and still very offensive, and ought to be more stringently legislated upon than they

have been in the past, more especially as it has been so often shown that the nuisance can be easily remedied by the owners.

Our local authorities are in some districts so lax in the administration of that section of the Public Health Act, 1875, relating to smoke nuisances, that the words therein contained are simply a farce, and the efforts of the Inspector a dead letter.

The problem of smoke abatement is getting rather ancient, and was legislated upon as far back as 1819, and since then several select Committees have been formed and have reported to the House the result of their inquiries, with the result that the clause relating to smoke nuisances was inserted in the 1875 Act, followed by a proviso that entirely nullified its usefulness.

Many offending manufacturers assert that the consumption of dense black smoke causes more injurious (though less visible) gases to escape in the atmosphere, but this can be at once passed over because experts conclusively prove that such is not the case, because light and dense smoke contain the same substances though in different degrees of mixture.

The production of smoke is no economy to the manufacturers but a waste of money in the shape of unconsumed fuel.

From correspondence that I have had from a number of Sanitary Inspectors I find that a great many are almost asked to let the smoke nuisance alone, and in at least two instances the Sanitary Authorities have said they wish they had a lot more smoke, it was a sign that trade was flourishing. In towns of that kind any effort an Inspector might make to try and remedy such a state of things meets with rebuffs, and I am of opinion that some central Authority should take the matter in hand and appoint Inspectors to take observations and report direct to them, the same as the Inspectors under the Alkali Acts; in such a way only can this great evil be properly dealt with and effectually remedied. A great many manufacturers try to make a set of boilers do far more work than they are able to, to the detriment of the atmosphere.

Many different kinds of apparatus are on the market for the prevention of smoke, all of which I suppose have some good point to recommend them to the manufacturers, but a very great deal depends on the height of chimney, mode of firing, fuel used and boiler space.

The experience of such well known gentlemen as Mr. A. E. Fletcher, Professor Ripper and others, all tend to show that the emission of dense black smoke can be avoided, or if not wholly removed can be so minimised as to be no nuisance, and that such has not been carried out before now is a serious blot on our Sanitary Legislation.

"*Practical Sanitation in relation to the Food Supply,*" by
LOUIS HANKS.

(ASSOCIATE.)

ABSTRACT.

THIS subject is one of importance to the public at large, as the seeds of much mischief to bodily health, if not danger to life, are undoubtedly contained in foods, produced, handled, or vended under insanitary conditions.

The groups of industries most concerned are those respectively of the Meat (including Fish and Game), Bread, and Milk trades. Meat should be procured from animals free from disease, for which reason both live-stock and dead meat should be officially under the inspection of the Medical Officer of Health of the district, and necessary veterinary assistants and qualified inspectors.

Live-stock should be protected from exposure, and from the risks of disease, and no diseased animal should be sold for food. Metal feeding troughs, dry and well-drained shelters constructed with impervious walls and floors, pure water, the absence of filthy accumulations, and the utmost cleanliness should be insisted on.

Improvements both sanitary and humane might be made in the mode of conveyance of live animals by ship and rail. Water should be supplied to animals on a journey even of a few hours duration, and to those in a lair awaiting slaughter.

Slaughter-houses should be constructed in strict accordance with the regulations set forth in the Model Bye-laws of the Local Government Board, and with the advanced knowledge of sanitary principles.

Butcher's men should be required to exercise greater cleanliness in their personal habits in the dressing and handling of meat. Shops devoted to the sale of meat and other foods should be, where possible, isolated from dwelling rooms, should be constructed and fitted in accordance with sanitary principles, with every precaution to promote cleanliness and freedom from insanitary nuisances, such as bad drainage, insufficient ventilation, impure water supply, or accumulation of filth or refuse. Care to be taken that no one engaged in a food business is suffering from or in contact with infectious illness. Bakehouses are under certain legal restrictions as regards sanitary matters, but need greater attention to details of improved construction, pure water supply, ventilation, freedom from dust and atmospheric pollutions, perfect sanitation, the use of machinery and improved ovens being advantageous as reducing the necessity for personal

contact with the bread in manufacture, although in all cases the good health and cleanliness of the men is of great importance.

Milk is a frequent propagator and carrier of disease, and should only be procured from a healthy animal, free from tuberculosis, etc., and housed in a dry, well drained, spacious, and well ventilated cow-house.

Great cleanliness to be used in milking, the cow's udders and milker's hands to be thoroughly cleaned before commencing. All milk vessels to be kept perfectly clean and scalded with steam or boiling water repeatedly. Milk should be sterilised before dispatch or delivery. Dairies should be isolated from cow-house, dwelling, or sanitary convenience, and should have all the provisions of hygienic construction specified for cow-houses, so that pure air, pure water, and freedom from risk of contagion may be ensured. All workers engaged in the cow-house or in collecting, handling, or distributing milk should be free from infection of disease, not only the recognised infectious disorders, but consumption also being dangerous through the agency of the milk supply

The water supply of dairies and milk shops should be of the purest description. Too frequently it is drawn from shallow wells which are polluted with the soakings from cesspools, drains, and farmyards, or from streams contaminated with sewage, and in this way typhoid fever and other water-borne diseases may be conveyed to human beings, either by means of cans, etc., washed in such water, or by its surreptitious addition to the milk.

Water-cress grown in water contaminated by sewage is also capable of conveying similar diseases, and such has also been proved the case with regard to oysters and other shell-fish taken from water similarly polluted.

The essence of sanitary teaching with regard to food is that the various articles should be procured from sources free from disease or disease-producing surroundings, that the produce should be systematically inspected and condemned if unfit for food before it is exposed for sale; that it should be shielded from accidental contamination or infection in transit or exposure for sale, that all premises devoted to the preparation or sale of food, especially meat, bread, and milk, should be sanitarily fit for such uses, and that cow-shed and dairy sanitation is of immense importance, not only as regards the susceptibility of milk to certain infective disease germs, particularly tuberculosis, scarlet fever, typhoid fever, and diphtheria, but also on account of the desired improvement in British dairy produce to enable us to compete on favourable terms with the scientific dairying of foreign countries such as Sweden and Denmark.

"*Local Authorities' Officers' Superannuation Bill, 1897*," *by* ROBERT LINDSAY, Sanitary Inspector for the County of Midlothian.

ABSTRACT.

THE introduction deals with the length of time during which England and Wales have experienced the benefits of measures for providing superannuation and compensation, and enumerates the various Acts passed in their behalf. And after commenting on the fact that, although many futile attempts have been made to get clauses providing for superannuation inserted in Bills dealing with Scotch affairs, Scotland still lacks the advantages of such a measure. The following points are taken up and briefly considered *seriatim*:—The question of superannuation as treated within the scope of the Bill; the dangers to which Health Officers are exposed while in the discharge of their duties, and the need there is for such a measure; the advance which the Bill makes on its predecessors in the manner of dealing with the question of superannuation; a reference to the text of the Bill, and its object—the extension of the provisions of the Poor Law Officers' Act, 1896, to the officers and servants of other Local Authorities in England and Wales; the benefits to be derived from the measure, as given in the 3rd, 4th, and 5th Articles of the Bill, and how these are to be provided; and the provision made for dealing with officers in London who come under the Metropolitan Officers' Superannuation Act, 1866. A remark in passing on the non-retrospective character of the measure and its compulsoriness after enactment, with a few observations on the provisions of Clause III. with regard to those who may wish to be relieved of its burdens.

A short account of the difference between the Act of 1896 and the present measure, with special reference to the stipulations for contributions and payment according to length of service. A statement of the wide interpretation of the words "Local Authorities," and of the definitions of "Local Rate," "Officer," and what it includes, "Servant," and how he must be appointed in order to participate. A reference to Clause V. which repeals the Metropolitan Act of 1866, and to the exclusion of Scotland and Ireland from participation, which is dealt with in Clause VI. of the Bill.

A concise criticism of the Schedule of the Bill, dealing with the question of those who are entitled to receive superannuation, and the age and conditions of retiral. Explanation of the method of fixing the allowance, length of service to be reckoned on the aggregate, and participants not to undertake other employment under penalty of deduction from the allowance of

amount so earned. Stipulation with respect to forfeiture of participation. Remarks on the provision for those who, through shortness of service or loss of employment owing to no fault of theirs, are not entitled to superannuation. The proviso with regard to joint appointments, and the decision of the Local Government Board being final in cases of dispute. Finally, general observations on the financial aspects of the measure, with reference to the providing for dependents of officers and servants, and the granting of relief during periods of temporary infirmity; and the desirability of having superannuation established independent of contribution, on account of the gain to the wealth of the country through reduction of the death-rate.

"*Case of Typhoid Fever in a House with Faulty Drainage, with Plan of Premises*," *by* H. ALFRED ROECHLING, Assoc.M.Inst.C.E.

(MEMBER.)

A.—INTRODUCTORY REMARKS.

AT the present time the opinion seems to be gaining ground that, because it has not yet been possible to establish experimentally a connection between sewer gas and disease, notably, typhoid fever, the former may be considered harmless.

This opinion appears to necessitate two principal assumptions, viz:—First, that we are already in a position to ascertain conclusively, and without any shadow of doubt, the nature and composition of sewer air or gas, and secondly, that all recorded cases of sewer gas poisoning—and their number is legion—are not correct, this being probably due to errors of observation.

To make these two assumptions seems to say the least very rash.

Those who know the imperfect methods for the analysis of sewer air, which we at present possess, and their many sources of error will agree with me, that we are not yet able to ascertain by experiment the whole of the component parts of this air or gas. Would we were in a position to establish for every specific effect the specific cause, but at present at any rate we are very far removed from this state.

As to the recorded cases of sewer gas poisoning, whilst I fully admit that some are very far fetched, and have their origin more in the imaginative brain of their observers than in fact, there are undoubtedly some, in which the various links of the chain of indirect evidence have been forged together so

well as to make it appear highly probable, that the secondary, if not the primary cause of the illness, was the action of sewer gas upon the constitution.

In the present state of our knowledge, a negative proof must not be taken to exclude the positive proof hereafter, and in matters of public health, when we have to deal not with individuals, but with ever increasing congregations of them, it appears to me very unsafe to throw away, as it were, the evidence of every day life—even though it be only circumstantial or indirect—and to rely solely on the at present somewhat weak experimental evidence! If theory and practice do not agree, surely it is a somewhat bold assertion to say the practice is wrong!

A case of sewer gas escape has lately come to my notice, in which the indirect evidence connecting the escape with a case of typhoid fever appears to be fairly strong, and as it is not always possible to supply so many links of the chain of evidence, I thought it might be of general interest to give the facts here somewhat fully.

B.—History of the Case.

1. *General Remarks.*—The town in which the case happened has a good water supply, and is also well sewered, but owing to a large number of complaints about noxious smells, a great many sewer ventilators at street level have lately been closed, so that a considerable length of sewers is a present not ventilated at all, or only very insufficiently ventilated.

The premises on which the sewer gas escape occurred, are situated in the centre of the town in one of the main thoroughfares, and were built many years ago, when building regulations where not even thought of. On the drawing facing page 120, I have shewn their ground plan, and from this it will be observed that the open space at the back, which is exposed to the sky, amounts only to 5 sq. yds. for the two houses; practically, therefore, the whole area on which they stand is built upon.

Formerly the two buildings were utilized as two shops by their owner, who also occupied portions of both of them with his family, but since his death they have been tenanted by separate people, who use a common back entrance at *m*.

At the beginning of 1896 one of the buildings was let to a new tenant, W., a tailor, who wished to modernize it, and for this purpose raised the height of the front room on the ground floor about 4 ft. and inserted a new shop front, alterations which cost him about £500. He took the place on a lease of fourteen years and according to the agreement W. is responsible for all drains and waterpipes inside the buildings, whilst his

landlord undertook to keep all external drains and waterpipes in good order and repair.

As W. has another tailor's shop he does not live on the premises, and the place is now used as a lock-up shop only.

2. *Drainage of the place.*—The drainage of the buildings is on what is known as the combined principle, *i.e.*, both W.'s shop and the one next door are drained by one 6 in. drain, which discharges into a small public sewer just beyond the point marked *l* on the plan, and this in turn empties itself at *n* into a newly constructed public sewer, which has a size of 5 ft. 3 in. by 3 ft. 6 in. and a fall of about 1 in 150. As can be gathered from the levels on the plan the fall of all the drains is good, but that of the 6in. house-drain has since the case of typhoid fever occurred been improved and a disconnecting trap at *l* inserted.

At the point marked *f* there is a small inspection chamber, which is closed by an ordinary wrought iron door with a locking arrangement, but there is no sort of trap in connection with this chamber.

The W.C. at *h* which belongs to the shop next door, is drained by a 6 in. pipe, which discharges with an awkward bend into the chamber at *f*. There is another 6 in. pipe joining the main drain at this point, which is shown on the plan to the left of the chamber, and which, I was informed takes the waste from a sink belonging to the shop next door to W.'s prémises.

The W.C. for the use of W. and his people is on the first floor above the one marked *h* on the ground floor and its soil pipe is shown at *i*. This soil pipe joins the main drain below the inspection chamber, and consists of a heavy cast iron pipe of 4 in. internal diameter with lead caulked joints, its ventilated end however is made of considerably weaker metal and has some awkward bends.

The W.C. on the ground floor at *h* has no windows or ventilation whatsoever and may be termed "a dark hole"; it is an old cased-in closet with a two-valve flushing cistern of the old type and a small bore flush pipe, from which the flush may be anything up to about 1¾ gallons according to the patience of the user. The W.C. for W. and his men consists of a modern pedestal flush down closet with a two-gallon syphon flushing cistern from an approved maker and is ventilated into the shaft over the lavatory *g* on the ground floor.

The flush from this W.C. is good, but although it is supposed to be a two-gallon one, it was not more than 1¾ gallons at the time of my visit.

For the use of W.'s shop there is a lavatory—just referred to—at *g* on the ground floor a detail of which is shewn on the

plan. Its 1¼ in. lead waste pipe discharges over a double trapped gully, which is connected with a drain joining the main below the 4 in. soil pipe. The outlet from the gully is jointed with cement to the stoneware pipe, which at this point passes through the wall.

At *q* there is a yard gully of somewhat similar construction with sludge bucket as the one just described.

The character of the plumbing of the old work is, as might be expected, decidedly inferior, and even that of the new work is below the recognised standard for work of this kind.

It has already been stated, that a great length of the public sewers is either not ventilated at all or only insufficiently ventilated, and the open manhole and ventilating covers on the 5 ft. 3 in. by 3 ft. 6 in. sewer having been closed down, the gases in it would be able to pass unchecked—before the case of typhoid fever occurred—through the small public sewer under the public passage into the house drainage system and fill it, until they found a vent through the open end of the cast iron soil pipe or wherever else they encountered the least resistance.

3. *Structural condition of the premises.*—I have already stated, there is practically no open space at the back of the block of buildings, the whole of the ground, with the exception of about 5 square yards having been built over.

In that portion of W.'s premises which have not been renovated, the whole of the windows and doors being old, fit badly, and admit a greater or less current of air through them when closed; it is important to bear this in mind in the future remarks.

Over the lavatory at *g* there is a long light shaft of somewhat irregular rectangular shape (see the dotted lines on plan), which has a height of 18 ft. 6 in. and is covered with a skylight, half of which can be opened for ventilation. Into this shaft, as already stated, is the W.C. on the first floor ventilated.

The window *k* in the fitting-room which has a glass area of 27½ square feet, could, before the foreman cutter B. fell ill with typhoid fever, not be opened, as it was thought unsafe to have such a window in a lock-up shop on the ground floor for fear of burglaries.

The door *c* of the fitting-room fitted so badly, that in March, 1896, strips of wood had to be nailed on the frame to stop the strong draught, but at the time of my visit, February, 1897, it still allowed plenty of air to pass through when closed.

In the yard at *r* is placed the movable dust-bin (galvanized iron with a lid) of W., and at *s* that of the shop next door.

At *p* in the fitting-room is the large table, at which the foreman cutter stood and worked the greater portion of the day.

This table is about 9 ft. long (see plan), and has a height of 3 ft. The fire-place of this room is on the opposite side, but it was not used before the case of typhoid fever occurred.

The fitting-room is divided from the shop by a wooden partition, with an opening of 18 square ft. for the passage to and fro. The height of the fitting-room is 8 ft. 6 in., and its cubical space 1,346 cubic ft.

The shop, which W. considerably improved, has good proportions and is well lighted and ventilated. Its cubical contents are 3,761 cubic ft., and the glass area of its windows (mat surface glass) is 52 square ft. Above the windows are small ventilating openings, which extend over the whole width of the shop and ventilate the same into the two shop windows containing goods on show, whence the air can pass through a large number of similar openings into the street. The front door has a clear opening of 21 square ft., and over it right up to the ceiling is fixed a movable fanlight with an area of 12 square ft., which moves round hinges at the bottom, and can be opened 10½ in. on the top. The room is lighted at night by two gas pendants with four incandescent burners each, and the shop windows by electric arc lights.

I was informed that the front door *a*, and the fanlight over it are always open, and that during the summer months, and immediately before B. was taken ill the doors *d* and *e* were also mostly open. At the time of my visit the lock at *d* was out of order, so that the door could not be properly shut. The door *c* was always closed, but I have already stated, that in spite of the strips of wood fixed to it it fitted very badly. As to the skylight over *g*, I was told it was practically always open.

When showing me over the premises the son of W., who manages the place for his father, told me that ever since taking possession of them they had noticed unpleasant smells in the back rooms, notably in the scullery and the room above, and with a view to prevent them had disinfected the drains with carbolic acid, and admitted as much fresh air as was possible. In his claim for damages B., the foreman cutter, had utilized this, and stated that W. was aware of the defective state of his drains. At the time of my visit I noticed a distinctly fusty smell in these rooms, which had a strong flavour of urine.

4. *Staff employed in shop.*—I have already stated that the son of W., who is about 22 years old, manages the business for his father, consequently the latter visits the place only very occasionally.

Besides the son, there was a foreman cutter B. employed, whose duty was to measure the suits, &c., cut them out, and then try them on. He was generally at work on the table *p*, in

the fitting room. As far as I could ascertain his age was about 45.

The son was generally in the front room with the apprentice, a lad of about 17 years, to attend on the customers coming into the shop.

The errand boy, about 14 years old, was in and out of the premises a great deal during the day to take out parcels or messages, and can therefore not be said to have kept to one room.

On the top floor of the house one tailor was at work, but as this is two stories above the ground floor we need not trouble about him here any more.

The working hours were from 9 a.m. to 7.30 p.m., with one hour for dinner and half an hour for tea; on Thursdays the shop was closed at 2 p.m. B., the foreman cutter, used to go home for dinner, but had his tea on the premises, so that it might be said he was at the shop for 9½ hours every day; his wages were about £4 10s. per week.

5. *The foreman cutter, B., taken ill with typhoid fever.*—After the improvements had been carried out the shop was opened about the end of February, 1896, and from this time right up to his illness B was every day on the premises.

On the 17th day of September, this being a half-holiday, he took a drive into the country, and on his return home got caught in a heavy storm and thoroughly drenched to the skin.

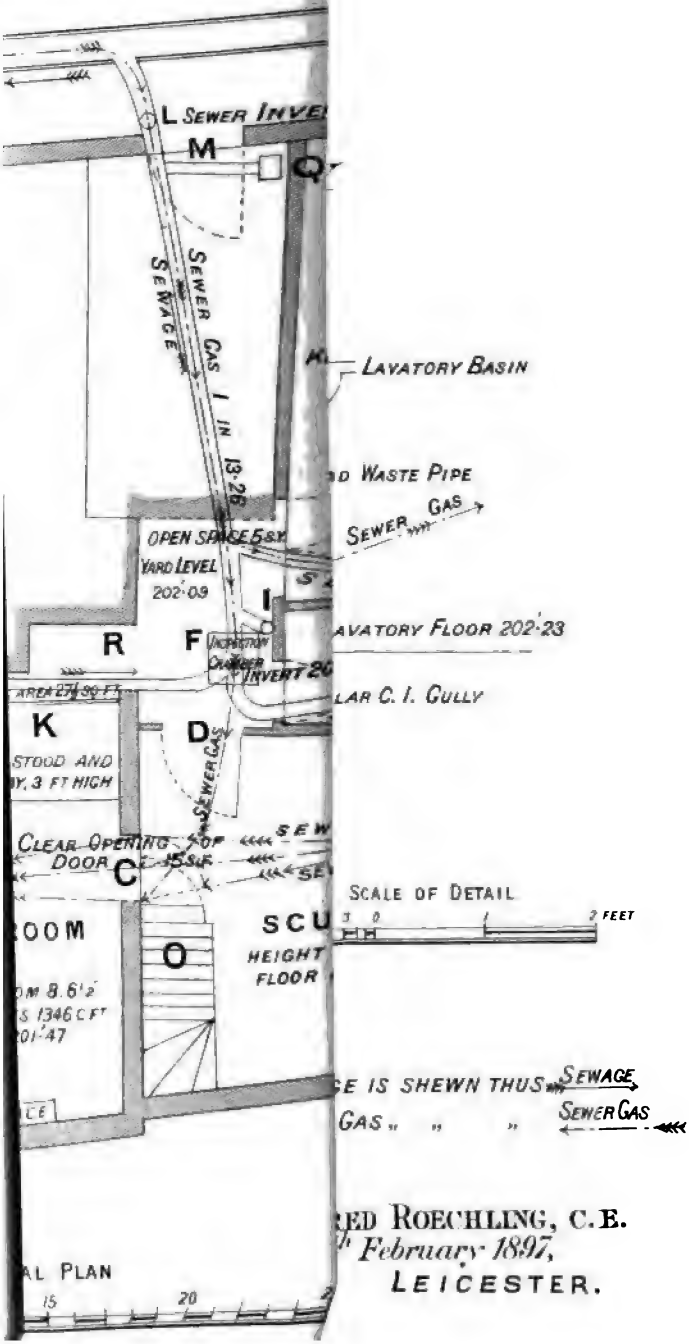
On the 19th day of September, 1896, so it was alleged in the claim, he contracted typhoid fever, but continued to work for some days after at the shop: the certificate of notification is dated 7th day of October, 1896. B. was absent from work for about six weeks, after which period he returned to W.'s shop.

6. *Examination of drains.*—After the receipt of the certificate the smoke test was applied to the drainage of the house, where B. lived, on the 9th day of October, and as no defect was discovered the drains of W.'s premises were next examined. Here a defect was found in the lavatory *g*, where smoke issued from a crack in the wall a little above the gully, see general plan of premises and detail of lavatory. The escape though clearly visible was not a large one, and on further examination it was found to proceed from a crack in cement joint between the cast iron outlet of the gully and the stoneware pipe.

In consequence of this the landlord was asked to remove the gully outside the buildings and to lengthen the lead waste pipe accordingly, but as it was found such a course would entail structural alterations and would otherwise cause difficulties the gully was allowed to remain; it was thought well, however, to improve the fall of the 6 in. main drain, and to insert a disconnecting syphon at *l*.

OUSE WITH

OF PREMIS



RED ROECHLING, C.E.

February 1897,

LEICESTER.

The crack in the cement joint round the gully outlet may not have been due to bad workmanship, but might have been caused by the giving way of the stoneware pipe or the gully outlet owing to the pressure of the wall on them, and such a settlement of the latter would account for the crack in it above the floor through which the smoke was seen issuing.

7. *The foreman cutter claims damages.* — B., after his recovery, endeavoured for some time to get damages from W.'s landlord for loss of employment, &c., through typhoid fever caused through faulty drains, but finding it difficult to make the landlord in law liable he eventually claimed damages of W. himself. In his particulars B. states, that W. was aware of the state of his drains and claims wages for six weeks, the payments to his medical attendant and to his nurse (£1 1s. per week) though he was nursed, as I am imformed, by his wife; altogether the claim came to about £35. W. not being willing to pay this amount went to consult his solicitor, who instructed me to carefully examine the whole case; my connection with the case, therefore only dates from this time.

8. *Examination of the premises by myself.* — Immediately after the receipt of my instructions I proceeded to W.'s shop, so as to be able to examine the premises without previous preparations for my visit having been made.

The condition of things I found has already been described in the previous pages, and it will only be necessary to add here one or two remarks.

In the back rooms, and especially in the scullery, I noticed a distinctly fusty smell with a strong flavour of urine, and on entering the yard observed some liquid standing on the bricks by the side of the inspection chamber at F. I gave orders to open the iron cover and found the chamber completely filled with excreta, paper, urine, and water, forming a semi-liquid mass.

Just as we were discussing this shocking condition of things the occupier of the adjoining shop, who is the son of the late owner of the premises and has lived on them all his life, came out and told us somewhat calmly that he had noticed the overflow of sewage from the chamber and had endeavoured to remove the obstruction in the drain but without success. He maintained the drain had never been previously stopped up, but from his manner and from the arrangements evidently made for such contingencies I came to the conclusion that such an occurrence was by no means very rare.

I therefore endeavoured to find out the cause and had not far to seek. It will be noticed on the ground-plan that the 6 in. pipe from the W.C. at *h* has a sharp and awkward bend just

before entering the inspection shaft, and as the apparatus is an old cased-in closet with an old two-valve flushing cistern and a small bore flush pipe, the flush is at times insufficient to convey the excreta round this curve. They are consequently deposited in this place and moved a little forward with every succeeding flush, until the semi-liquid mass completely fills the cross-sectional area and blocks the drain. On a second occasion, after the obstruction had been removed, I tested this closet and found my apprehensions completely supported by the facts I then observed.

Eventually the County Court action was not proceeded with, but settled by arrangement out of Court, B. receiving some compensation.

9. *Condition on premises summarized.*—It may not be out of place, before endeavouring to give an explanation of the whole case, to state shortly the condition of things on the premises prior to B.'s illness.

a. There is practically no open space at the back of the premises.

b. The ventilating covers on the public sewers in the neighbourhood of W.'s shop have been closed down for some years, and there is a sharp rise from the public sewer to the house-drains.

c. There was no intercepting trap between the public sewers and the house drain.

d. The soil pipe is badly ventilated owing to several awkward bends in this length.

e. The w.c. at *h* is a dark hole and its fittings are bad.

f. Although when the drains were tested no smoke issued from the inspection chamber at *f*, its cover having perhaps been previously carefully shut by the tester, the state I found it in with liquid sewage oozing from it leads me to the conclusion that foul smells may have frequently proceeded from it.

g. It is admitted that unpleasant smells have been continuously observed in the back part of the premises.

h. When the drains were tested there was a distinct escape discovered in the lavatory at *g*, no leakage having been previously found at B.'s house.

i. The door at *e* was always open.

k. The door at *d* was open during the warm weather.

l. The draught through the door *c* was so strong that pieces of wood had to be nailed to the frame, which somewhat moderated it, but did by no means altogether prevent it.

m. The position of B., during the greater part of the day, was at the work-table *p* in the fitting room and just in the line of the draught from the door *c* through the opening at *b* to the front door at *a* which was always open.

C.—Explanation of the Case.

I think it will readily be admitted that the foregoing points are strong evidence in favour that B. may have been and was actually exposed for some time to air containing sewer gas in a comparatively undiluted state. There is, however, no evidence to prove that this air contained the typhoid germ, no case of typhoid fever having been notified from the neighbourhood of W.'s premises. I will not here take into consideration the possibility that a case of mild enteric fever might have occurred in the vicinity of the shop without having been attended by a general practitioner.

But the absence of the typhoid germ does not by any means prove the absence of other substances dangerous to health, and from careful observation and analogous reasoning I am led to believe that sewer gas does contain such substances, which, when inhaled for some time, lower the vitality of the system, or better perhaps break down its protective forces, whatever they may be (leucocytes, &c.), so that when in this state the constitution is attacked by hostile germs such as, for instance, the typhoid germ, it has no longer the power to resist its pathogenic action and falls an easy prey to its ravages.

This, I am inclined to think, explains the action of sewer gas upon the human system.

Where, in that case, B. met the typhoid bacillus is impossible for me to say, but that it must have entered his body somewhere is beyond doubt, unless, indeed, we hold that there can be typhoid fever without the bacillus typhosus.

The fact that neither the son of W. nor the apprentice contracted typhoid fever might be explained by their not having been exposed in the same degree as B. to sewer gas—it will be remembered they were chiefly in the shop, where the air was considerably more diluted owing to the good ventilation, and in which they would naturally move about from place to place—and further, by their not having been to the locality or place where the typhoid germ entered the system of B.

In matters of public and private health, prevention is far better than cure—if, indeed, the latter be possible at all—and although the evidence I have produced is only circumstantial or indirect, I am strongly of opinion it would be most unwise and most detrimental to count it for nothing and declare sewer gas harmless.

CONGRESS AT LEEDS.

CONFERENCE OF LADIES ON DOMESTIC HYGIENE.

The proceedings of the Conference commenced with an address by the President, Mrs. Fawkes, published in the Journal, Part III., Vol. XVIII.

"*A Sketch of the Work of the Health Department of the Yorkshire Ladies' Council of Education,*" *by* Mrs. R. W. Eddison.

ABSTRACT.

A Ladies' Committee was formed by the Yorkshire Board of Education in 1870, to aid in the great work of the improvement of their fellow women. Three principal objects presented themselves and committees were formed to carry them out. To the Health Committee was confided a scheme which took cognizance of Domestic Economy and Sanitary Science. After arranging for lessons in Reading, Writing, Arithmetic, and Sewing for women and girls above the age of twelve years, they began to consider how they could foster a wise care of health, and employed peripatetic lecturers. These did not gain the best results, and ladies volunteered to have friendly talks on Health to women invited to meet them. Medical Men gave instruction and assistance to the lady lecturers. These were very successful and the work was only limited by the number of volunteers. Prizes were given for answers to questions at the end of courses; interest spread to the men, who desired to join them, but could not then be allowed to do so. In 1873 the committee felt the work growing beyond them and arranged for a two years' course of lectures in connection with the Science and Art Department. Forty-six students attended them, and those who passed the examinations were awarded a teacher's certificate by the Science and Art Department. The majority of students were of the pupil teacher class, precisely those most desired.

The intimate connection between Cookery and Domestic Hygiene was early felt, and the Yorkshire Training School of Cookery was established in 1875 at Leeds, York, and Wakefield. The students take the examinations of the Society of Arts in Domestic Economy, and of the Science and Art Department in

Physiology and Hygiene, and in the other subjects now added to the curriculum the relation to Health is never lost sight of. Branches of the Council at Leeds, Sheffield, and Wakefield, carried on the work on the same lines.

A subscription list in Leeds ensured the continuance of free lectures to mother's meetings, &c., and paid lecturers were engaged to travel in the county. Mr. London, Mrs. Spencer, &c., continued to give most successful courses for many years. Mr. Pridgin Teale, Dr. Edith Pechey, Dr. Eddison, Dr. Bush, Mr. R. P. Oglesby, Miss Florence Lees, &c., gave courses of lectures to educated women on Physiology and Hygiene.

In 1881, the committee endeavoured, but unsuccessfully, to make an experiment in Leeds with a sanitary visitor and sanitary house to prevent the spread of infectious diseases—on the Hastings plan. The Corporation was unwilling to make the necessary grant towards the cost.

In 1890, after the passing of the Technical Instruction Act, the Ladies' Council appealed to the West, East and North Ridings County Councils, and to the Leeds City Council to devote a portion of the funds (customs and excise) to the promotion of Technical Classes for women, in Cookery, Laundry Work, Dressmaking, and popular lectures on the laws of Health, and Home Nursing. The scheme of the Ladies' Council was adopted in its entirety by the East Riding County Council. Examinations are held at the end of the courses and the lectures have greater continuity there in consequence. The West Riding has scheduled sick nursing as a grant-aided subject.

Subscriptions from Leeds members are devoted to free lectures to Mothers' Meetings, &c., in Leeds, and to the maintenance of a sanitary visitor paying fourteen visits daily in a particular district for the past two years. The latter is now discontinued from want of funds. The visitations are recorded, sent by the Lady Superintendent to the Hon. Secretary of the Sanitary Aid Association, and eventually reach the Medical Officer of Health, who reports them to be of great value. A distressing amount of immorality is discovered, and the authorities are asked to exercise some check on the letting of furnished rooms which abound in the low part of the city.

The committee wish to continue their work if they receive support from the public, and their experience has taught them that the best results are obtained from a judicious admixture of voluntary and official effort.

"*Women as Hygiene Teachers,*" *by* Miss Alice Ravenhill.

ABSTRACT.

A still prevalent ignorance of the elements of Hygiene is but too evident on all sides; the need of definite instruction to dispel this ignorance is now generally recognised, as also the fact that women of all classes, on whom depend the health of the home, are usually willing to accept and apply hints on Domestic Sanitation when given by one of their own sex, if judgment, tact and discretion be exercised in the teaching.

Woman's love of detail and quick perceptions pre-eminently adapt her for being a competent Hygiene Teacher, if she also possess a good education and knowledge of the World, faith in her precepts, sincere devotion to her work, courtesy, sympathy, a sense of humour, ready resource, and above all, good health, in addition to her technical qualifications, which must be of an essentially practical character. Great importance of everywhere adapting teaching to varying acquirements of the audience, in town or country, whether rich or poor. Desirable therefore to acquire at every centre visited a knowledge of the conditions of existence, rate of wages, prevalent industries, system of drainage, source of water supply, etc. Illustrations by models rather than diagrams usually more successful and attractive. In reply to objections raised against this "popularisation of Sanitation from the platform" attention should be drawn to the fact that this method does not assume to replace systematic instruction, but meets a great want amongst those now responsible for the well being of many households, the parents of the rising generations, who did not share the advantages these now enjoy.

Many centres of training in Hygiene and Domestic Sanitation now available to women throughout the United Kingdom to qualify them for this teaching. Considerable variation in their standard of efficiency, but adapted to requirements of all, from those desiring highly scientific instruction to those satisfied with a more popular aspect of the subject—these include Bedford College for Women, the National Health Society, Liverpool Ladies' Sanitary Association, &c., &c.—while good private instruction by correspondence is also procurable. The employment is very interesting and varied, but only fairly remunerative, having hitherto been chiefly confined to the winter months; there is an increasing demand for Teachers who will take permanent posts as Lecturers under Technical Education Committees, or Health Missioners among the poor. Authorities, when arranging salaries or lecture fees, should

take into consideration the responsible and somewhat arduous character of the work when conscientiously done, in order that the remuneration may be sufficient to secure the services of really competent women.

This calling has proved the stepping-stone in several cases to more public appointments. Ladies have been selected to fill the position of Factory and Sanitary Inspectors, and to hold various posts under the London or Provincial County Councils, from the ranks of hygiene teachers trained by the National Health and kindred societies. Very desirable that all women should realise the necessity of a practical acquaintance with the laws of health in every vocation of life, whether public or private, as possessing a most important influence on the welfare of the Nation; utility of women as Poor Law Guardians, Members of School Boards, or of Urban, Rural or Parish Council much enhanced if they possess a sound knowledge of this subject.

"*The Education of the Speaking Voice,*" *by* ARTHUR BURRELL, M.A.

ABSTRACT.

HULLAH remarked how inferior Englishmen are to any other nation in the natural and artificial perfection of the vocal apparatus. All writers on the subject and our own experience go to show how careless and inaudible most speakers are. The Universities, the Church, and the Schools all neglect voice-training, the Elementary Schools alone making a semi-satisfactory study of it.

To come to practical suggestions. We must first find and train our teachers. When the teacher is found he must study the peculiarities of his pupil's voice. These peculiarities are something quite apart from pitch, intensity, and timbre; the natural beauty of the voice is not to be disturbed.

Voice-power is developed and attained by (*a*) ventilation of rooms; (*b*) easy clothing; (*c*) cleanliness; (*d*) gymnastics.

Correct rules for inhalation and exhalation are necessary. "Shut your mouth."

Vowel and word exercises follow, to be said, sung, and whispered.

Finally comes the reading lesson in which one pupil only has a book, being stopped by his fellow pupils when a word is missed.

All this is preliminary work to the higher study of reading and speaking.

"*Health in Infants' Schools*," *by* Mrs. E. L. Connor.

(Associate.)

ABSTRACT.

The past decade has seen a great improvement in the sanitary condition of elementary schools; perfection, however, has not been reached, especially in Infants' Departments. Many managers are still to be found, who have a vague idea of the difficulties connected with baby life and training. Ladies are now taking an active part by becoming managers, and the result is highly satisfactory.

Annual examinations being practically abolished, teachers are enabled to treat their scholars as tender plants needing careful, loving attention, rather than little machines to be wound up for an annual exhibition.

One of the impediments to hygienic progress is the rule respecting space. It is unreasonable that infants should be allowed less than older children. If anything, they require more.

Proper ventilation is still misunderstood. No direct perceptible draught should be felt. All infants' rooms need an *open* fire-place. The fire is a splendid purifier, and is wanted as much on a chilly, wet, summer's day as in the winter.

School cleaning is an important item, but as managers differ in opinion as to the *amount* required, there is a remarkable irregularity in carrying out this needful operation. Statistics often show that schools in districts with very few poor or dirty children, are cleaned once a fortnight; whilst others, in crowded neighbourhoods, and packed with children from neglected, and dirty homes, are cleaned only five or six times a year! The attention of managers indifferent to the subject would be called to it, if a question were inserted in Form IX. respecting the number of times school-cleaning had taken place annually.

The wrong position and insufficient ventilation of cloak-rooms is often dangerous to the health of infants, and the origin of much sickness.

Many playgrounds still have no covered part, or it is too far from the building to be of much use. The asphalte paving is often soft, and intolerably hot in summer. It would be a splendid arrangement to cover part of it with sand a foot or two deep.

There is no need to place the lavatories so far away from the main building where the drainage system is good. Under present arrangements, infants are often obliged to run against cold winds, rain, and snow.

In many large towns nearly all that is necessary is done regarding notification of infectious diseases to Day schools, but there is a serious omission as regards Sunday schools; consequently, infection has been spread, especially in the treat season.

Much evil will be prevented when measles, chicken-pox, and whooping-cough are classed with infectious diseases.

To prevent the spread of infection, should not the school drains, dust-bins, and cisterns be at once inspected after a case of scarlet-fever, diphtheria, and typhoid fever? At present this is often omitted.

The inherent tendency to disease, the disadvantages of environment, the sudden encroachment of some epidemic, often leading on to fatal results, should all be matters of interest and careful consideration. Much of the physical, mental, and moral health and strength of the future generation depends largely upon the attention paid *now* to "Health in Infants' Schools."

"*The Sanitary Aspects of Gardening as a Profession for Women,*" *by* Miss GOODRICH-FREER, Hon. Sec. Horticultural College, Swanley.

ABSTRACT.

ONE of the great sanitary dangers of the present day is the standard of activity, mental and physical. We are living, not merely to the extreme of our physical capacity, but we are often educated beyond our brain power, and aim at a standard of achievement beyond the strength both of mind and body. We stimulate where we should soothe, and thus produce a state of irritation which leads to exhaustion on the one hand, and to morbid activity on the other.

To this morbid activity, especially in women, this straining at any cost to be *clever*, we owe in a great degree the extreme opinions, the intemperate aggression, which those of more healthful development deplore.

At the present stage of our social evolution, we are especially in need of the soothing and calming influences of outdoor life. Nature is somewhat restoring the balance, in giving to the rising generation of women a tendency to a finer physique, with an aptitude for out-door and athletic exercise.

For them, as well as for somewhat elder women it would be advantageous if, as so many must now work for their living, we could find out-door employment for the educated which should be, at the same time, healthful and commercially profitable.

The profession of gardening, among others which might be suggested, seems to meet such requirements, as there is much work to be done in Horticulture for which the taste and manipulation of women are specially adapted, and which moreover, in its highest development, turns to account the intellectual attainments of the more highly educated.

Horticulture, besides the art of gardening, includes some knowledge of chemistry, botany, entomology, geology, of surveying and mensuration, of light and heat, of horticultural building, of book-keeping and of many other applied sciences.

But such knowledge to meet the special requirements we have supposed must be *trained* knowledge, or it will fail of its purpose. Where there is imperfect knowledge, there are struggles and the evils of irritation and strain as elsewhere.

During the past five years more than a hundred women have passed through such training at the Horticultural College, Swanley. They have taken the highest places in all outside examinations, and for practical work and produce in a great number of exhibitions. One took the Gold Medal of the Royal Horticultural Society, against 300 competitors. All who have proved efficient have readily obtained employment of a kind both healthful and profitable. They are engaged as head gardeners on private estates, in market gardens, as gardeners and teachers of gardening in Institutions as well as in the Royal Horticultural Gardens, at Kew, and at Edinburgh.

They have voluntarily performed as students, every kind of manual labour required of ordinary gardeners, and have found it well within their capacity.

The Council of the College includes seven doctors, and such well-known physicians as Sir Edward Sieveking and Mrs. Garrett Anderson, have testified in the highest terms, from personal knowledge, of the healthfulness of gardening as an occupation for women.

On "Our Milk Supply and some of its Dangers," by
Miss H. J. Hutchinson.
(Associate.)

ABSTRACT.

The author is of opinion that while great advance is being made in sanitary knowledge by almost all classes of the community, there is still great indifference to such vital questions as how best to obtain pure and wholesome food, and especially is this noticeable with regard to our milk supply, although it has been proved beyond doubt that milk may in three ways at least be the vehicle by which disease germs gain access to the human body.

First: milk may convey disease direct from the cow to the consumer, a fact which should arouse the vigilance of all intelligent people when we consider that from 40 to 50 per cent. of our milch cows are now said to be tuberculous. Is not this a powerful argument in favour of the compulsory application of the tuberculin test to all cows?

Secondly: strict investigation should be made by the consumer as to the place of abode of the milk-seller, as the milk very often stands there in unsanitary surroundings for some hours before delivery, and not unfrequently receives the germs of any infectious disease which may be present in the neighbourhood.

Contamination by impure water used for washing tins, or for adulteration, may also occur there. Milk should also be frequently tested for its reaction (which should be alkaline) on delivery, and there should be no sediment after standing. If it "sours" quickly, suspicion should be aroused.

Lastly: all milk should be boiled or sterilized before use, and should then be protected, by covering, from the air of the larder, which may contain certain bacteria capable of chemically changing the milk, and which if introduced into the human body may produce grave gastric and intestinal disturbances

---

The following papers were also read :—

"*The Preservation of Sight in Children*," by H. Bendelack Hewetson, M.R.C.S.

"*The Church and Sanitation*," by the Rev. F. Lawrence.

"*Hygiene in Education*," by Mrs. Frances Steinthal.

RESOLUTIONS PASSED AT THE CONGRESS HELD AT LEEDS, 1897.

During the Congress resolutions were passed at the various meetings, and were in due course submitted to the Council of the Institute. After careful consideration certain decisions were come to by the Council, which are set out below following each resolution.

As the various meetings at which the resolutions were passed cannot now be informed of the action taken, the Council thought it well to set them out here for the information of those interested.

Recommendation made in Section II :—

"Recommending the Council to print as a separate pamphlet at an early date the papers relating to Sewage Disposal, with the discussion upon them."

Decision of Council.—Referred to the Journal Committee to publish at once if practicable.*

Recommendation made in Section III.—Chemistry, Meteorology and Geology :—

"That the Council of The Sanitary Institute be requested to print Prof. Kendall's paper on 'Geology of Leeds and District, with special reference to the Water Bearing Strata' in extenso, with the important illustrations."

Decision of Council.—That Prof. Kendall's paper be printed, with illustrations, in the Journal. (Vol. XVIII.—Part IV.)

Recommendation made in the Conference of Municipal Representatives :—

"That this Conference of Municipal Representatives was both popular and successful, and suggest that the Conference be held at future Congresses."

Decision of Council.—That a Conference of Municipal Representatives be held in connection with the Congress at Birmingham.

---

* This pamphlet has been published, and can be obtained at the Office of the Institute.

Resolution Passed in the Conference of Medical Officers of Health :—

"That this Conference of Medical Officers of Health, held in connection with the Congress of The Sanitary Institute at Leeds, recommend the Council of The Sanitary Institute to urge the Government to enquire into the prevalence of cases of illness due to the use of canned foods, and to adopt such action as the evidence would justify."

Decision of Council.—That a communication on the subject be sent to the Local Government Board.

Recommendations made in the Conference of Sanitary Inspectors :—

"That the Council of The Sanitary Institute be recommended to print Mr. J. Lindsay's paper on 'Scottish Sanitary Jurisprudence' in full."

Decision of Council.—That the paper be printed in full in the Journal. (Vol. XIX.—Part I.)

"That in order to remedy the grievous nuisance from Black Smoke and to remove the difficulties attending its abatement, this meeting recommends the Council of The Sanitary Institute to bring under the notice of the Local Government Board the desirability of forming a Joint Committee of Representatives of Counties and County Boroughs for the putting in force the provisions of the Public Health Acts with regard to such emissions."

Decision of Council.—That no action be taken on the recommendation as to smoke abatement, made in the Conference of Sanitary Inspectors.

"That this meeting of Sanitary Inspectors held in connection with the Leeds Congress recommends the Council of The Sanitary Institute to support the Superannuation Bill promoted by The Sanitary Inspectors' Association, and the Local Authorities' Officers."

Decision of Council.—That the Council are not prepared at this stage to pledge their support to any one Bill.

Resolutions Passed in the Conference of Ladies on Domestic Hygiene :—

"That the Ladies' Conference on Domestic Hygiene desires to call attention to the fact that Women Sanitary Inspectors are doing good work in Liverpool, Manchester, and other cities, and to urge the desirability of the appointment of one or more Women as additional Sanitary Inspectors in Leeds. The women of Leeds will support by all means within their power any action which may be taken in that direction by the Leeds City Council."

Decision of Council.—That a copy of the Resolution be forwarded to the Leeds City Council.

"That the Conference of Ladies on Domestic Hygiene, held at Leeds during the meeting of the Sanitary Congress, respectfully appeal to the Council of The Sanitary Institute, that they will organise Examinations for girls and young women in Hygiene, and that they will draw up and direct a syllabus of work to be done on the same lines as those of Sanitary Inspectors. This would ensure that the older girls understand intelligently not only personal and household laws of health, but the Public Laws of Health, and would create a better mutual understanding between Sanitary Inspectors and heads of houses where the house is infected."

Decision of Council.—That The Institute will co-operate with County Councils in holding such Examinations if the County Councils grant the Certificates."

THE EXHIBITION.

It is hardly necessary now to explain that a Health Exhibition does not simply consist of drain-pipes and various accessories for getting rid of foul water, but probably many of the Members of the Institute do not fully understand the important part that the Exhibitions play as an adjunct to the work of the Congresses.

Congresses and Meetings for the discussion of every variety of subject are now the order of the day, and the value of illustrating subjects brought under discussion is as far as possible recognised, but very few attempts are made on such a large scale as those of the Exhibitions of The Sanitary Institute to demonstrate by an object lesson the theories propounded at the meetings.

The Exhibition of the Institute is in fact a practical illustration of the application and carrying out of the principles and methods discussed at the meetings; and it not only serves this purpose, but

also an important one in diffusing Sanitary knowledge among a large class who do not attend the other meetings of the Congress.

The collecting together of a large number of Sanitary appliances manufactured in various parts of the country, and the judging and premiating of them by a committee of experts, also has a marked effect in improving the construction of these appliances.

In order that the Exhibition should as far as possible play the rôle of illustrative teaching, the Committee confine the exhibits to such as are of an instructive nature from a Sanitary point of view, and classify them so as to enable comparison between articles of the same kind to be more easily accomplished, and yet more effectively impressed, and the exhibits are as far as possible described in the catalogue.

Further than this, the application of hygienic principles in various circumstances of life are illustrated by Classes and Demonstrations, held on such matters of domestic economy as Cooking, Dressmaking, &c., and the importance of Physical Drill is impressed by demonstrations given by children from schools.

At the Exhibition held at Leeds twenty-two classes of children from Voluntary and Board Schools entered for the Cookery competitions, which were held daily in the Exhibition. The several school authorities co-operated in the arrangement of the demonstrations, and in showing great interest in the educational effect on the children engaged. For the demonstrations of Physical Drill 620 children from various Schools entered, and the demonstrations were conducted under the direction of the Drill Instructor. No fixed apparatus was used, and the drill was such as could be adopted in other schools, or in many instances would be suitable for physical development in private houses. Nursing demonstrations were given in a temporary hospital constructed in connection with the Exhibition. The hospital was supplied with all the necessary furniture and fittings, and a hospital nurse was employed there daily, carrying on, with the assistance of lay figures, the ordinary occupations that would occur in hospital routine, and giving information on matters relating to nursing to any of the visitors who were interested. In addition to these special demonstrations, lectures were given on hospital practice and appliances, and an attendant was there to explain and demonstrate the more technical appliances exhibited. During the period of the Exhibition a number of other demonstrations, including Laundry work, Millinery, Modelling, &c., were carried out under the auspices of the Yorkshire Ladies' Council of Education, and were attended by a large number of ladies, many of whom specially visited the Exhibition for this purpose.

All of these were arranged so that they should attract visitors to the Exhibition, in order that more or less directly the Exhibition might impress upon them the importance of hygienic conditions, and the all-pervading part that hygiene should play in every circumstance of life.

E. W. W.

POLLUTION OF WATER SUPPLIES.

By Prof. W. H. CORFIELD, M.A., M.D.
(Fellow.)

Read at Sessional Meeting November 17th, 1897.

I have been asked to say a few words, not so much on the subject of the discussion itself, as upon the dangers of pollution of municipal water supplies from the general point of view. On my way here I remembered some lines of Virgil, which seemed so appropriate, that I thought they would be interesting to you as showing, that even in the time of Virgil, it was recognised that water might have been the means of transmitting disease. I quote from Dryden's translation:—

> " Here from the murky air and sickly skies,
> A plague did on the dumb creation rise;
> During th' autumnal heats th' infection grew,
> Tame cattle and the beasts of nature slew;
> Poisoning the standing lakes and pool impure,
> Nor was the foodful grass in fields secure."

I think you will agree with me that it is remarkable, that even in Virgil's time, as these lines show, it should have been recognised that diseases—those of animals at any rate—could be transmitted by infected water. Of diseases which may be communicated by means of polluted water, I will first mention diarrhœa. This disease is frequently caused by drinking water situated close to cesspools and from cisterns directly connected with drains and sewers, so that foul air from them has got into the cisterns and so into the drinking water, but I do not know, as a matter of fact, that any serious outbreak of diarrhœa has been caused by a public water supply. This may be owing to there not being sufficient pollution to cause such an outbreak. There has certainly not been sufficient pollution to poison a community. In households, cases have occurred which have been traced to leakage from soil pipes into cisterns. This shows, that to cause such an outbreak, there must be a much more serious pollution than can be admitted as possible in any water supply

properly regulated. Nevertheless, I think that summer diarrhœa may perhaps often be caused by infected water supply. Scarlet fever is a disease which we might expect to be conveyed by polluted water, because we frequently find epitheldal scales in drinking water. But in no instance that I have been able to trace, either on a large or small scale, has scarlet fever been attributable to the drinking of water.

Diphtheria is now prevalent in many large towns, but it was not so formerly, it was always considered a country disease. The generally received view is that it is not communicated by water, the observations of Dr. Browning seem to show that diphtheria may be communicated by water deliberately contaminated, so that we cannot now say that such method of contamination is impossible, but we can say that no serious outbreak has been traced to polluted drinking water.

Cholera was first traced to polluted drinking water by Dr. Snow, and he was the first to demonstrate this fact. In the epidemic of 1849, his investigations in Wandsworth showed the disease was distributed by means of the water which the people drank. The outbreak in Westminster, in 1854, was traced to a pump in Broad Street. A committee was formed, of which the late Prof. John Marshall, of University College, was the reporter, to ascertain the cause, and it was clearly shown that the cholera cases were only found among those households that used this pump for drinking water. When the disease broke out a great many people left Westminster, and some went to reside in Hampstead and Highgate, and water from this pump, which was highly esteemed because it was "such nice clear sparkling water" was sent to them in bottles, and it was amongst those who used the water sent in these bottles that the only cases of cholera were found in those districts. Sir John Simon's report of the cholera epidemic of London in 1848-9 and 1853-4, showed that the localities in which cholera was specially prevalent were almost entirely determined by the degree of impurity of the water supply. Before 1853, two water companies were taking their water from the Thames near Hungerford Bridge, and the death statistics showed that from 12½ to 13 per 1000 of the people who drank that water died. One company in 1853, removed its works to Thames Ditton, the other remaining at Hungerford Bridge. In the outbreak of 1853-54, the death-rate among the customers of the company which had remained at Hungerford Bridge was still 13 per 1000, while that of the customers of the company which had removed to Thames Ditton the rate was only 3·7 per 1000. In the cholera epidemic of 1832 in Glasgow, people took water from the Clyde, and the deaths numbered 2,842. In the

visitation of 1854, they still took water from the Clyde, when there were 3,886 deaths. Before the cholera epidemic of 1886, Glasgow had obtained Loch Katrine as a source of water supply and the number of deaths were 68, instead of three or four thousand. In 1866, there was an outbreak of cholera in the East End of London, which was investigated by Mr. J. N. Radcliffe, who ascertained that the water supplied from Old Ford reservoirs of the East London Water Company, had for a few days been distributed without being filtered. It was also found that the dejecta of a cholera patient had got into the Lee from which the East London Water Company draws its supply, so that the reason of the outbreak was conclusively shown to be water pollution. In the case of the cholera epidemic at Hamburg, water pollution was again proved to be the cause of the outbreak. It was shown that Hamburg drew its supplies direct from the Elbe, while Altona used filtered water also from the Elbe, Hamburg suffering terribly from the epidemic, while Altona escaped through its system of sand filtration. Nevertheless I should not depend upon sand filtration on a large scale unless properly managed and continuously worked, as there is no reason why we should drink water that has been polluted, if we can obtain water from unpolluted sources.

Typhoid fever, which bears a certain resemblance to typhus fever, was first distinguished from the latter by Dr. A. P. Stewart, but it was Dr. (now Sir William) Jenner who demonstrated the difference in the ætiology of typhoid, which he found always showed the presence of excremental poisoning in some form or other, while the other was due to overcrowding. In 1874 I opposed the late Dr. Murchison's view that typhoid fever had a *de novo* origin. One case I instanced and would like to mention, is that of a female servant in a large country house, which came under my own observation. There were no other houses in the neighbourhood. The girl, one of twelve servants, slept with the other girls in a room on one side of the house, she alone being attacked. She was not in good health, had been overworked, had not had a holiday, and, being in a low condition, was no doubt in a fit state to take the disease. After a great deal of inquiry it was found that there had been typhoid at a cottage six miles off, and it became a question how the infection could have been communicated from that distance. It was ascertained that a boy from this cottage, who worked in canal boats, came home ill and died of typhoid. Two men living in the cottage caught the fever, one of whom worked in the grounds about the house in question. Both men worked until the third week of the typhoid attack, one of them then

went home and died, the other got well. Thus people suffering from typhoid may go about for weeks without knowing they have got it, and so spread the poison wherever they go. This shows that persons suffering from enteric fever may continue at work even to the third week, and then die suddenly. About a fortnight before the servant girl had been taken ill a drain in the yard was found choked and filled with sewage, and there could be no doubt that one of the two men ill with typhoid, who used to visit one of the servant girls as her sweetheart, had frequently used the W.C. in the yard. When the drain got blocked and had to be taken up, this particular girl, being in a low state of health, easily caught the infection, while her more healthy fellow servants did not.

Another instance I should like to mention is that of a small fishing town on the south coast of Cornwall. Amongst the places that most suffered during the Cholera epidemic of 1866, was this little town, which was decimated with cholera whenever it broke out. A young man came home ill from a disease which was found to be enteric fever, and in a very short time there were 150 cases in the town. The excreta of the young man first attacked were discharged into the stream, and it was from this stream that the people obtained their supplies of drinking water.

Typhoid fever was prevalent at Millbank prison long before 1840, when typhoid was first recognised as a separate disease. The numerous deaths from diarrhœa and the prevalence of abdominal diseases led to the suspicion that they were the result of drinking the water of the Thames as it flowed past, and this proved to be just the cause. After the authorities stopped using Thames water, and obtained it from the artesian well, from which the fountains in Trafalgar Square are supplied, typhoid ceased in the prison, and there was never any other case there, except imported cases, from that time till the prison was pulled down. In the case of an outbreak at Caterham, Sir Richard Thorne proved that it was caused by the pollution of the well-water by the dejecta of one of the men employed at the wells. In another case which occurred at Caius College, Cambridge, and which was investigated by Sir George Buchanan, it was found that the cause of the mischief was the suction of sewer air into the water pipes on account of a defect in the plumbing.

Water may be poisoned by the pollution of springs as well as by the pollution of wells. A very peculiar outbreak occurred from this cause in 1872 at Lausen in Switzerland, of which the following description is given in one of the reports of the Rivers Pollution Commissioners.

"In August, 1872, there occurred in Lausen, a village of 780 inhabitants in the Basle Canton, Switzerland, an outbreak of typhoid fever, the village having for many years been singularly free from that disease, and in fact from all epidemic diseases. About a mile south of Lausen there is a small side valley, the Fürlerthal, separated from Lausen by a hill. In an outlying farmhouse in this valley a peasant who had lately been travelling away from home was attacked with typhoid fever on the 10th of June. On the 10th of July a girl in the same farm was seized with fever, and later on the peasant's wife and child. Nothing was known of this outbreak in Lausen, when suddenly on the 10th of August ten of the inhabitants became ill with the fever, in nine days more the number attacked was 57 and in four weeks over 100 were prostrated. Altogether, until the termination of the typhoid fever at the end of October, 130 people were attacked. On investigation it appears that all the houses in the village who drew their supply of water from the public watercourse, were attacked by the disease, while six houses, where the inhabitants drew their water from their own private wells were exempt. The public watercourse arises from a spring at the foot of a hill on the side towards the village. There are some farmhouses in the Fürler valley but these escaped all infection. There could be no doubt that the Fürler brook was polluted by the evacuation of the typhoid patients, as it flowed by the side of the farmhouse both from the privies and from the receptacles for night soil, as well as from the washings from the clothes of the patients. Now ten years previously a hole suddenly formed close by the side of the brook below the farmhouse in which water was seen to flow, and for the sake of experiment the whole of the brook was diverted into this hole when it disappeared under the ground and was seen no more. After one or two hours the springs in Lausen, which were almost dry owing to drought began to flow copiously, at first yielding a muddy water which later became clear and continued to flow copiously until the Fürler brook was again turned into its original course and the hole filled up. On subsequent occasions when the fields below this spot were irrigated by damming up the Fürler brook, the springs in Lausen after a few hours began to yield a more copious supply. Between the middle and end of July in 1872, these fields were irrigated with the water which at that time was polluted with the excreta of the typhoid fever patients, and the springs in Lausen became more copious, the water being thick and foul tasting. Three weeks later the disease suddenly commenced in Lausen. Subsequently the experiment was retried of opening up the hole by the side of the Fürler brook and diverting the

latter into it, when in three hours time the yield from the Lausen springs was found to be doubled. A large quantity of salt was then dissolved in the water of the brook and in a short time there was a decided salt taste in the Lausen spring water, but on mixing flour very finely ground with the water of the brook the solid constituents of the Lausen spring water were not increased and not the slightest trace of a starch granule could be distinguished in it. These experiments were sufficient to show that the water of the brook passed through layers of earth which served as efficient filters for solid particles like flour but were not sufficient to destroy the infective germs of the typhoid evacuations. Nevertheless I believe that in this case the water passed mainly through crevices in the rock.

With regard to the outbreaks at Worthing and Maidstone, which are so recent, I will say nothing about them, as they will be subjects for discussion by other speakers. It is generally supposed that typhoid, which we now call enteric fever, and cholera travel in the same way; but I can prove to you that there are between them some great differences which we do not understand. Lyons, in France, for instance, is singularly free from cholera, which has never spread in the town itself, although it has been introduced from Paris, and had been widely spread in the villages round Lyons. Lyons, on the other hand, has always been a hotbed of typhoid fever, and I have seen in the hospitals there all the medical wards and half the surgical wards full of typhoid fever patients. That shows that there is a difference in the propagation of these two diseases, which we do not at all know the reason of.

I will conclude by reading an extract from a letter which I have received from a gentleman in Kent. He says, "Throughout the Weald of Kent, on the clay and on the sand, as also on the clay and chalk beyond, there are few wells from which any potable water can be obtained, and the people are obliged to draw their water from streams and ponds, beyond what they can save as rain-water from their roofs. This is the case in numbers of villages, farms, and labourers' cottages, and in this district, representing a population of many thousands; in fact, I should say the rural population of Kent would exceed the urban. The hop growing extends from a little west of this place (Hildenborough) eastwards to beyond Maidstone, and during the season of hop-picking the country is covered with encampments of people of the least sanitary class, frequenting by preference the proximity of streams and rivers for the convenience of obtaining water and of washing their clothes. It is a confirmed belief amongst this class of people that hop-fields are very healthy and restoring to the feeble, the sick, and the

convalescent, and there is no doubt that many a convalescent from typhoid is taken to the hop-fields, and their linen, which may not have seen the tub for weeks, is washed in the adjacent stream. Should any of the streams become polluted during the present outbreak at Maidstone by cases removed from that town during convalescence, it might spread the disease into the villages and amongst the rural population. I have not seen this state of things alluded to in any of the correspondence in the medical or lay press, and I think it is not known what a large number of people are dependent for their water for daily use on the streams and rivers of this county. I hope your discussion will be the means of moving the county sanitary authorities to inquire into the state of the water supply for the rural population not only of this, but of other districts with little or no well-water."

[*For discussion on this paper, see page 152*].

CONTAMINATION OF WATER SUPPLIES BY ENCAMPMENTS OF HOP-PICKERS, GIPSIES, ETC.

BY MISS CHREIMAN.

Read at Sessional Meeting, November 1897.

ABSTRACT.

AT the commencement of the Summer vacation of 1895, I had occasion to visit Hawkhurst in Kent.

I found there, as elsewhere, an opinion that for the four or five weeks of the hop-picking, the pickers have a delightful and most healthful holiday; but, watching with some care, I had no little occasion to doubt this, and I decided to visit for fuller observation more central districts of the industry.

I did not get far, for I found a perfection of wretchedness that held me close for such poor tinkerings of relief as here and there I could effect; and so, anear and uncovered, I looked upon this so-called holiday, a gangrened wound at the vitals of

the nation, as different from the pleasant phase of simple country labour and rest that would add to our national virility, as is the freedom of its perditions from the happy liberties of law and order.

I went alone next year for even poorer tinkerings, and this year I am only putting in train a little plan for some supply of free or cheaply cooked food for ailing women and children, which I hope may be possible.

This on a large scale, if some one abler would take it up, would be a useful sanitary measure, for wholesome food is a proved preventive of sickness as well as of crime.

Many people go down a week or fortnight before commencement of the picking, afraid of not being in time for engagement, or ordered by hospital doctor to "get into the country"; and I wish you could all watch just once as the kindly mistress of the coffee tavern at Paddock Wood tries to minister in the dead of the night to these holiday (?) makers, with nothing to spend, and nowhere to go; to crying children and mothers literally too weak to keep their babies in their arms.

The hardest economist amongst you would put his hand in his pocket and make easier the halfpenny cup and slice they pay for, I think. And they *do* want work. To many this year Mrs. Shadwell, the tavern keeper, made loans of money; all but one found work and repaid her.

We insure ruinous multiplication of our defective population by allowing the production of hundreds and thousands without serviceable hereditary aptitudes, and neglecting to take them off the roads. And one cannot be about the country without seeing how largely this is the case. For instance, I saw an idiot girl of seventeen the mother of two children, and a father and mother with six, tramps all their lives.

Another item of waste that struck me was the very large number of tramps, picked men who have served the short military term, trained and disciplined at their country's expense on the road, whilst we are beating the country for recruits.

Considering numbers and conditions the amount of order is astonishing, but Vice revels, in the absence of powerlessness of authority to the most afflictive detriment of respectable poverty; and of some out-lying places after the nightly emptying of the public houses and often in the neighbourhood of the railway station, though here matters have improved, any enquirer may hear of frightful violence against which the few police are powerless.

"We don't interfere with the hoppers if they don't interfere with other people," say the police, and indeed they are utterly powerless to do so. And so men "fight it out," and women

too, not seldom with babies in their arms. And they are used to suffering, and punishment recoils upon themselves, and so they can bear most merciless bruising, and when fists and boots have done their worst, unconscious women are dragged to their shelters, or lie by a hedge until they can crawl to them.

I beg to put before you that such gatherings require that habits of obedience to law be established by more effective enforcement of lawful authority.

Would it not be possible to swear in some of the idle army reserve men who are on the unions; or hoppers of good character as special constables?

Dissatisfaction arises through the bringing down by farmers of vastly more hands than required, and there is no power to prevent this; a "catch and hold them" policy of not letting the people know the conditions of work and payment before they start work; the progressive demands of the "tally," and the grossly unfair practice of measuring which prevails, by which instead of the stated seven or eight bushels for the shilling, nine, ten, or more must be picked or heavy-handed measurers bribed. It is only of poverty that 25 per cent. more than a bushel can be bought for a bushel. They could not try it with their potatoes, or sell a bushel and two gallons of corn as a bushel. Is it strange that the needy people so provoked are not always exemplary in self-control?

Towards Canterbury, and in Surrey, I am told, three-bushel baskets prevent to a great extent the "measuring injustice." It *ought* to be prevented.

These people are not all unlovely. I could tell of tender care of infants and love of flowers; of generous giving even to the gift of life; of cleanliness and almost elegance amidst vile surroundings; of a grand British capacity of endurance that ought to be of more service to us.

I could tell of the marvellous benedictions of the air in recovered health; of heroic bearing and noble control under "weight of dire annoy," of some enjoyment, and a little honest laughter.

But these are not our business this evening.

We want some enforcement of separation of the sleeping places of men and women. Just one example:—

On the upper floor of one barn 45 ft. long, 18 ft. wide, with pathway down middle, roof sloping from 2 ft. 6 in. to 10 ft., forty-seven people were sleeping—men, women, children, youths, and girls; with no separation other than that a few of them contrived by use of their bed and day clothes.

The family compartments in some barns were comparatively well separated.

They were divided by hurdles through which straw had been loosely drawn. This, however, could not be said to give privacy, even if the door at one end had not served for the ingress and egress of the ten families.

Some of the dwellings of which the end walls, the divisions, doors, and beds are of straw look so dangerous that one wonders that fires, attended with considerable loss of life, are not of frequent occurrence.

Tents might perhaps be made fireproof—certainly many of them ought to be considerably more waterproof.

We *badly* want some provision for decent people of places where they can be decently lodged.

Is it altogether impossible for philanthropy to possess itself of a few blocks of model shelters and make use of them for holiday outings all the summer through?

We want some prevention of the hasty pairing of men and girls to meet the regulation of farmers who employ no single men. Such "matches" are frequent, and much of the subsequent birth worse than infanticide.

We want *some prevention* of absolutely poisonous overcrowding.

In the casual wards of the unions, with beds overfilled, and corridors paved with human riff-raff (or the unfortunate in process of conversion into riff-raff) unwashed, clothed in living rags, and packed close as sardines; and in many of the cattle-pens, with their manure-mud floors, or the upper compartments of huts receiving impure gases from rooms beneath, the nights of the herded ones must be sleepless, or their sleep of an anæsthetic character; it cannot be the sleep of health.

Probably many are only saved from asphyxiation by the impossibility of making these shelters as draught-proof as their paucity of bed-clothing inclines them to do; and by the benevolent antagonism of carbonic acid to the laws of gravity and cohesion.

Sickness, diarrhœa, spasm, and general *malaise* are frequent, of course, boils and carbuncles sometimes follow; but these pains and penalties are nature's danger *signals* and *protections;* unchecked retention of the morbid poisons would mean *painless* death.

In the almost unrestricted travelling and distribution of these people in conditions of incubation, is it not certain that we have explanation of not a little of the prominent mortality and the prevalence of non-fatal, foul air and water-borne disease, common to October and November, so that much of the suffering and death,—as well as birth and vice—accredited to London is due to the hop and fruit harvests.

And is not this in some way the business of London?

Disinfection of the hop-pickers' trains should be thorough and regular.

At the end of one harvest attention was called to a case of diphtheria on a cattle fold. The patient was detained, the other lodgers of the fold returned home next morning. These people had been lying upon a bed of short straw, beneath which was a mattress of cattle manure two spades deep. Could fever desire a better hot-bed, or better chance of diffusion?

A fortnight after the picking of 1895, I went down with Mr. Coyle, a London Architect, who had very kindly undertaken to give me some suggestions for better housing.

It struck both of us that the disinfection of the shelters, the cleansing or earth covering of the latrines (where these exist), and some attention to their excrement-sodden approaches and the removal of the leavings of the hop pickers, might be wise, and at an early date after completion of the picking.

In many cases the hoppers are hurried from the fields, with what looks like indecent haste, tents being pulled down whilst they are being paid off—they wash and shave and change their clothes in the roads. It seems to be no one's immediate business to remove these clothes, numbers of old boots and stockings lie about. One red jacket rested close to the top of the well-used steps between the Station and Maidstone Road, for three weeks.

Wells, I am told, go for twenty perhaps fifty years without cleansing. I heard of one well that was not disused until the dead frogs and snails and newts had so "tumbled to pieces" that the stench of the bucketfuls drawn was unbearable—and of another disused for years because its water was black, that just by means of a big bunch of holly and furze-bramble weighed with bricks became the envy of the neighbourhood for beauty of flavour and appearance.

I heard of one farmer having water boiled and sent round for use of the pickers, and most employers would provide water, but good water is a great luxury in several places in Kent. At least one property owner in Paddock Wood is between the horns of a dilemma. He has been served with notices to discontinue the use of well-water under a penalty of £20, and his tenants will not use the supply of the water-works company.

People at Paddock Wood reasonably ask why they should pay for water that may poison them if they drink it, and spoil their clothes if they wash them in it.

It does seem that privilege of possession and supply ought to cover reasonable certainty of protection, cleansing of dams and courses, and preparation for use; and that the "taking good dividends, and taking away our friends and bread winners who pay them," as one householder put it, ought to be prevented.

A little enterprise and expense would make an excellent supply available at Paddock Wood.

A splendid spring exists close at hand with completest natural advantages for reservoir and conveyance.

Provision of some kind is necessary, to prevent the bathing of swollen legs and sore feet, the washing of shirts and pants and stockings, and worse defilements of water, afterwards "caught" for drinking and cooking. This goes on in various places during the hopping—and all the year round in "wash up skippers"—or pieces of accessible water courses sheltered by trees and a hedge where impecunious travellers wash, cook, spend a night or nights, and so "skip" the Union. It is not pleasant to see watercress from these beds "enjoyed."

Rough temporary laundries might be possible. A doctor who had a practice in Notting Hill, told me that a good many laundry girls out of work during the London holiday season go down for the picking, and, added the doctor, considerable increase of practice always follows their return.

It seems to be probable that infection is sometimes conveyed to cattle and poultry by contaminated water and vegetation.

In fact we have on every hand a superabundance of the best food for the growth and development of malarial influences; cycles of infection need manifold calls for cleansing, ventilation, and some provision or substitute for drainage to prevent air and water fouling by noxious products of decomposition, with extensive evaporating surface.

I visited before, during, and after the hop-harvest a field, on which during the harvest were 170 tents—"housing" each from three to fifteen men, women, and children. On this field I was informed that there was not a single sanitary convenience. On another farm was *one* for the use of some hundreds of people—absolutely unapproachable, and (if I remember rightly) apparently draining into a pond, from which it is to be hoped that water was not drawn. Most of these people fetched water from a somewhat less stagnant pond farther off.

Foods absorb the poisonous effluvia of the sleeping-places, and—stale at time of purchase—are soon in a state of putrefaction.

A food case might be a possible addition to improved dwellings. I kept milk for a few sick people sunk in the earth in tin pails.

We want local inspectors aided, for better oversight of supplies of food. I sometimes saw meat hideously evidencing its need of condemnation.

I heard that bacon that needed *chaining* was being "doctored" (will members of the Profession of Medicine kindly

excuse the term) for sale in a shed; and knowing that one historic pig had been credited with the infection of 158 persons, and seeing raw bacon eaten, I could not but think that the aches and pains of some of these people as likely to be from *Trichiniasis* as from suppressed gout.

Some of the hop-pickers' beer is abominable stuff, and I remember hearing either Dr. Taffe or Dr. Carpenter state that bad beer was almost as likely as milk to be a medium of infection.

I heard grevious complaint of tinned meat the half-day I spent at East Farleigh this year.

Please understand that I am not gainsaying much painstaking provision, by local tradesmen, of food of astonishing quality, considering its price.

I realized (very sadly sometimes) the difficulties the people find in getting supplied. This is more especially the case with milk—often greatly needed for infants and the sick.

We want knowledge of disease at its onset; and I do not see how compulsory notification is obtainable unless assistant inspectors mix with the people at the bins and elsewhere and get it by observation of premonitory symptons. Suspected cases might then be removed to hospital tents.

The late Sir Edwin Chadwick once told me that during a cholera epidemic he borrowed military tents from the Tower for a somewhat similar purposes.

Such hospitals even if only for first aid to the injured, would I should think, be great help to the local doctors and a boon to many sufferers—and cases of pneumonia, bronchitis, feverish rheumatic conditions, rapid decline of consumptive infants and children brought down for "their health" are far from infrequent, and conditions for nursing, dying (even burial, though this matters less) are very different from what should be desired.

I was frequently struck by the determination to "get back to London" directly illness manifested itself, or at any rate so soon as it became serious, and the danger of this is obvious.

And some painful cases of suffering from delay of conveyance of injured persons to hospitals several miles distant, came under my notice.

I wonder if there is any way of destroying the odour of the egg and fish manures, so largely used on the fruit and hop grounds?

I am told that fish manure is laid a foot deep over some of the hop fields, and that when the decayed fish is brought in during October, and its trucks stand at the station, and waggons full or emptied pass along the road, the stench is unendurable.

How men accomplish the loading and unloading is a mystery.

Hundreds of gulls are attracted by this fish: "eight," said one of my landladies, "fell dead in our garden last year, nasty stinking things, my husband threw them into a ditch at the bottom of the garden." This was of Elm Tree.

I cannot believe that any smell can be worse than that of egg manure, and a deposit of thousands of rotten eggs and their straw which I saw within a few yards of some hoppers' huts made the sense of smell torture for weeks, as, owing to the greatness of the mass, reduction of temperature to point of cessation of offensiveness was very slow.

It ought at least to have been lightly covered with earth to lessen the evaporating surface, and so minimise the giving off of morbid particles likely to give erysipelas, or carbuncle, or diphtheria to the individuals in proximity to it.

Surely much improvement is possible in respect of the conveyance of the pickers.

In respect of fares, pleasure parties are carried in far better carriages, at convenient hours, without tedious delays, &c., and at, I believe, greater reduction of fares.

To Paddock Wood, ordinary third class fare is 2s. 11½d. By the "cheap" hoppers' train, 2s. Would it not be possible to arrange for the arrival of the night trains at a time, 5 or 6 a.m., when people can get to their places of work, instead of lying about the roads and platforms for hours with most of the waiting rooms locked, and arrangements for comfort utterly insufficient, or absolutely wanting? To give the people the status of fourth class passengers with fixed starting times, &c., instead of beasts of burden and other chattels, started when the trains are sufficiently over-loaded.

The night journeys have been improved, but are not free from debasing and demoralising neglects, and it behoves the railway companies, and our Christian Government, if beyond the power of the railway companies, to make our railway system of better service to those whose low degree of civilization is a public danger, and to whose personal and collective mal-influences all public contact ought to effectively oppose educative contrast, and evoke wholesome self-control.

Some of the people drive down from London, and I never once knew any remonstrance or attempt to prevent over-loading, over-driving, flogging or starving of the worn and jaded beasts. There seemed to be no knowledge that *dumb creatures possess sense of pain.*

It is legal and usual to open public-houses for three-quarters of an hour after the arrival of the night trains. Would it not tend greatly to the comfort of the women and children, and to the lessening of frictions, noise and delay, if these houses were

permitted to open not for the sale of "hoppers' beer" and spirits, but on condition of supplying cheap breakfasts of coffee and bread and butter, with if possible milk for infants and weakly children?

Might not the workhouse better serve the community, better conform to the spirit of the law, by making provision for better lodging (old reserve military tents might be available for this perhaps), and for some service of soap and water without punitive detention whilst so many penniless wayfarers are anxiously seeking work, whilst it is necessary easily to obtain labourers, and whilst Church and State need for their slum-dwellers the outings of which they may yet learn the beneficent possibilities.

I acknowledge the difficulty of the problem, but national questions ought to be righteously faced, and, as (let us hope) a large majority of the people are not rogues, it hardly seems ethically sound for the workhouse to usurp the function of the prison, and punish by excess of engagement-prohibiting detention.

Nor to me—except on the principle that "from him that hath not shall be taken even that he hath"—does it seem quite the thing to exact for such housing as previously mentioned, and one lb. of bread, with "nothing further" (as in very large type the notice outside Penbury Workhouse puts it) the breaking of *not less* than ten cwt. of stone on four successive days', even for a second application for admission within the hopping month, whilst applicants are liable to seven or fourteen days' hard labour for sleeping out. Ought not better management to provide soap and towels and a little courtesy, and still leave some change due to the impecunious lodgers?

I met at Penbury, an exhausted footsore family dismayed on finding they had a further six miles to walk to get and return with an order of admittance to the workhouse for the night.

Might not this great and useless hardship be removed and the admittances issued from an office adjoining the workhouses? The only apparent advantage of the usual plan is the possible recognition occasionally of some one "wanted" and for all the unwanted to pay for this in soul destroying weariness can hardly be ethically sound.

The workhouse that serves Maidstone is, I am told, at Coxheath, about five miles distant.

With regard to the great question of cost of reforms we have, among other things, to consider that our requirements are being made in days of greatly lessened values of the produce of the harvests by foreign competition and protection, and we have to consider the difficulties of provision for great numbers for a very limited period yearly.

The entire community, notably London, would share the advantages, and it seems to me that a policy of voluntary assistance, as well as official compunction, might be a paying policy—I think the hand of benevolence might do well to facilitate improvement and lighten the burden of municipal pressure, in the interest of those, by whom and for whom, the outing is so much needed, and of the employers whose shrinking profits and growing responsibilities already tend to its curtailment.

The matter wants looking at all round, and I think you would do well to take two or three of the leading growers into your council. I heard constantly of the fairness and kindly vigilance of Mr. White, of Bellering, near Paddock Wood, who, I have been told, employs two to three thousand pickers. His arrangements include zinc houses, cooking places and latrines, pumps, a fire engine, medical advice, a printed list of regulations, a weighing of hops, said to be nowhere else in use—which prevents gross unfairness of measurement—and some care for the departure of the pickers. I don't know Mr. White—he may be here, for he was invited, I believe—I think his co-operation would be of service.

I have been asked if I observed the work of the Church. Sirs, I observed it enough to say that your *greatest sanitary measure* would be the conversion of the majority of churchmen to the truths that a few of their number are always so splendidly illustrating, and talismanic touches of divine ointment were so obviously inefficient that much I wished that those who send a handful of missionaries and scripture readers (with free hearts and tied hands) into the teeth of the tempest—to tell the strugglers therein that perhaps they may be buffetted by earthly winds and waves right into a heavenly harbour of peace—could realize the cumulative and concentrated force of the secular, in lives in which the secular (a 'pitifully limited region of it) holds all the facts.

These men were charged to take Christ to the people, and they made their presentation with an ingenuity and readiness of application of His attributes and teachings (in gentle sympathy and stern reproof) that rarely failed, and seemed to me altogether admirable.

It was hard for them to find their "all satisfying spiritual facts" confronted and opposed by the supreme verities of hunger and dirt and hopelessness.

What an epoch-making quickening of heart and conscience we should have; what absorption of factional and individual into judicious national effort and expenditure might follow, if you could induce the church to estimate its responsibilities as

if its God understood mundane mathematics, and would follow early audit of effort and achievement by proportioned condemnation or award.

I wonder if, then, their churches and chapels would be closed all the week to these homeless and harrassed ones.

I think that not only for prayer and praise, but for decent feeding (perhaps cleansing); and for the great miracle of opening their eyes to their condition and requirements, their duty to the State and neighbours they distract, and the children and animals they torture, these doors would be opened wide. This would be so much *saner* than requiring our wastrels to sing

> "Goodness and mercy all my days
> Have surely followed me,"

and fancying that in some hidden way Providence is doing *our* work.

Even if for part cost of the new departure the church kept some thousands of pounds of its missionary money on this side of the ocean for a while, and so spared its members the giving up of their competitive extravagances of entertaining and adornment.

[*This discussion applies also to the paper by* PROF. W. H. CORFIELD.]

The CHAIRMAN (Sir Douglas Galton) read a letter he had received from the Chairman of the Sanitary Committee of Maidstone which ran as follows: "I very much regret that I cannot attend on Wednesday next, for, as you may suppose, the questions to be discussed are particularly interesting to me as Chairman of the Sanitary Committee. I may say that I cannot entirely agree with the statements made by the correspondent of *The Times* as forming a correct judgment of the question of the housing of the hop-pickers. We must bear in mind who they are and whence they come."

He also read the following extract from a letter received from Dr. Adams, the Medical Officer of Health and Analyst of Maidstone: "I am very sorry to have to decline to take part in the conference on the pollution of water-supplies. I would willingly do this but my time is so taken up with the duties of my office at the present time that I should not be able to do justice either to the Institute or to myself."

Dr. G. H. FOSBROKE (Worcester) said when he received an invitation to attend and make a few remarks on the pollution of water supplies by hop-pickers, &c., he accepted that invitation with

much pleasure, as the discharge of the duties of his office in Worcestershire had brought him much in contact with hop-pickers. Sir Douglas, as Chairman of the Sanitary Committee of the County Council—and he hoped that Sir Douglas would long be spared to them to adorn that office—instructed him to enquire into the conditions under which the business of hop-picking was carried on, and he conducted the enquiry towards the end of the season of 1895. There are in the county eight rural districts in which hop-growing is carried on, and in one of these districts he found fifty-seven hop gardens; and although some were not many acres in extent, others extended to several hundreds of acres. Hopping usually commenced in August and lasted until the beginning of September. Of course it is necessary for the harvest to be gathered very quickly, and that being so the local labourers are totally inadequate for the work, and large numbers of hop-pickers drawn from the "Black Country" are imported to assist, the majority being people of the lowest class. It was found necessary to maintain a number of police to keep them in order, and eventually the farmers tried to improve on the class of labourers to be imported. Now farmers go down beforehand to the "Black Country," and find some old dame who will undertake to engage hop-pickers on commission, and generally women are engaged. It is found that women do more work than men, are more industrious and certainly more orderly. Too many of the farmers have no house in which to lodge these people, and the result is that many have to be put in draughty cattle sheds and barns foul and damp, out of which the farmers had turned their cattle. But these conditions did not everywhere prevail throughout Worcestershire. Some gentlemen thought this state of things would not do, and tried to make better provision. Some of the leading agriculturalists supplied their casual labourers with food and bedding. The result of such an undesirable state of things was that some contracted pneumonia, others scarlet and typhoid fevers, or diphtheria. They laid on heaps of straw, and did not call in medical aid until extremely ill, and then they would send for the parish doctor. After the hop-picking season is over we get outbreaks of scarlet fever, which are evidently due to importation of the disease. He was instructed by the County Council to draft a set of regulations, and these were put in force in several districts, but other district Councils did nothing. This could be done quite well under Section 314 of the Public Health Act of 1875. These regulations were similar to some of those in force in Kent, and require huts to be waterproof, to be limewashed annually before using, to be generally sanitary, and to be provided with fireplaces, one for every twenty persons. The picture of the state of the pea-pickers is still worse. A farmer who grows peas one year will not grow them the next year, and as he has only casual harvests which only last a fortnight, does not feel justified in going to the expense of erecting shelters for the pickers, and generally no provision at all is made. The pea-pickers are generally tramps and those of the worst class. Some find bundles of pea-straw, known as pea-haulm, to lie

upon, and many have no shelter. Some sixteen or seventeen years ago he was called upon to investigate in the town of Evesham an outbreak of typhoid. A few days after the regatta he was informed of a large number of cases that had broken out in all parts of the town. He found that these people had consumed lemonade made from the water of a certain well near which was a camp of van occupants and gipsies who sold so-called ice cream and lemonade which were only iced water. All the evidence pointed to the probability that the outbreak was due to the pollution of this well through the filthy habits of the occupants of the gipsy camp. He feared that many other sources of water supply were not what they ought to be, although, through the influence of district councils, a better state of things now prevails. By enforcing these regulations for hop-pickers many of the evils could be removed. The powers given under the section are permissive only and not compulsory. There is a *may* still existing, but I hope the time will soon come when may will become *shall.*

Dr. J. S. TEW (M. O. H. for West Kent) said, we had heard from Miss Chreiman a good deal about the hop-pickers, and of the way in which farmers treat them. He was quite aware of the shortcomings of some authorities in regard to the water supply and the bad state of the hop-pickers, but if the sensational statements made were left unchallenged many would go away with a wrong impression of the way in which hop-pickers are housed in the County of Kent. We have also heard from Dr. Fosbrooke of the state of matters in Worcestershire, and of the low type of persons who are employed there, but he was afraid those coming into Kent were drawn from a still worse source. We get every kind and sort, but to assert that nothing is done to benefit them is quite wrong. With regard to the model by-laws framed under Section 314 of the Public Health Act, some which apply to urban districts may not apply to rural districts, but suitable by-laws have long been in force in the rural districts of Bromley, Cranbrook, Maidstone, Tenterden, Sevenoaks, Tunbridge, West Ashford, Dartford, and Bexley, and other districts in Kent, and at the beginning of every season a notice is sent to hop-growers calling attention to these by-laws which he knew to be regularly enforced in most of those districts. He had before him the Thirtieth Annual Report of a society formed for the better carriage and the improvement of the hop-pickers. It has certain rules by which the hop-pickers can be benefited while in the hop fields. It provides for notice to be sent to the hop-pickers likely to come, of the accommodation and the size of the hopper-houses at the different points. This society appears to be not much known, but it does good work and is conducted principally by hop-growers. Special requests are made to prevent from being sent, persons who are ill or who cannot work. People who come down beforehand are the cause of much apprehension, but many of them are tramps, gipsies, and habitual loafers not seeking *bonâ fide* work. All cases of zymotic disease are

at once removed for isolation, in some districts to permanent hospitals, and in others to temporary hospitals. He must certainly take exception to the statements made that the hop-pickers are totally uncared for.

Dr. Percy Adams (Deputy M. O. H., Maidstone) said: He was there partly to defend perhaps, and partly to hear what Dr. Corfield had to say about the pollution of water-supplies. He had observed some weeks before the outbreak at Maidstone, the appearance of diarrhœa as a precursor of the severe typhoid epidemic which followed. This was when he first had to make an investigation, and at that time the whole enquiry devolved on him. He was much struck with these premonitary cases, and he reported to the Sanitary Committee nineteen deaths from diarrhœa. The Committee then had before them but four cases of enteric fever. He found in certain localities large areas affected by diarrhœa, the indications being most marked in a certain section of the water-supply. In one section of the water-supply, which was regarded as the most suspicious they had had, a marked increase in the number of cases of diarrhœa before enteric fever broke out in Maidstone in an epidemic form. The point he wished to emphasize was this: Is it not worth while to draw attention to the relation, if any exists, between diarrhœa, and such allied diseases, which we may call colitis, &c., and well-marked enteric fever? If we were to apply the theory of evolution to these facts, should we not find them more closely related than has hitherto been supposed? He thought with Dr. Tew (who had even had a greater experience than himself, because he was a M. O. H. in the centre of the hop district) that "The Times" is a little too hard on us. Many of us in Kent have been brought up in great familiarity with the customs of these hop-pickers, and long immunity from serious outbreaks of disease may have dulled our apprehension of them. Sanitary science has made rapid progress, and our farmers have perhaps not picked up the threads too quickly, but he did not think the fault lay so much with the farmers as it did with owners. The letter in "The Times" from Mr. Hardy, Chilham Castle, shows how important these local interests are, and that there are honourable men in Kent who would do a great deal more for their pickers if they only knew how? This discussion will perhaps indicate what is being done in other counties. As regards the provision of latrines, the hop-pickers during the greater portion of the day are scattered over the fields far away from any places in which proper latrines can be provided. From a bacteriological point of view, as well as from the point of view of the Sanitarian, it would be infinitely worse to have improperly constructed latrines than if defæcation were made in the open air, and it would be impossible to provide proper latrines in the places where these people pass the greatest part of the day. We have perhaps been accustomed to think that these people come down every year and enjoy a fair amount of health, and perhaps farmers have come to think that as the hop-pickers have lived so many years without having

good shelters provided, they might continue to live without such. He thought farmers now saw that they were in error and that more provision ought to be made. There were undoubtedly cases calling for such reform, but there were also cases where food, water, and good shelter are provided, and where the hop-pickers are cared for as well as circumstances will permit. Altogether he was of the opinion that these insanitary conditions around Maidstone are very much overstated.

Dr. J. C. THRESH (M.O.H., Essex County Council), said it was difficult in following so many different speakers to avoid going over some of the same ground, but the great importance of the subject justified some reiteration. The necessity of protecting our water supply has been discussed for many years by eminent sanitarians, and too often apparently they have preached to deaf ears, but now the public was more willing to listen to advice. The alarming epidemics of typhoid fever at Maidstone and elsewhere have aroused public attention and emphasised the danger of neglecting the protection of our water supplies, and in future we may have reason to acknowledge the present calamities as blessings in disguise. He had had occasion to examine very many sources of water supply in this and other counties—supplies both for small and large communities—and in far too many cases he had found an almost utter want of care in protecting those sources. He had felt in some cases inclined to regard the carelessness and negligence as almost criminal, having regard to the unsuspecting and ignorant consumers. Besides the pollution due to hop-pickers, tramps, and gipsies, there are many causes from which pollution may arise. Wells and other sources of supply are often contaminated by the proximity of foul streams, badly constructed sewers, or public conveniences, but the contamination caused by encampments of van people, harvestmen, tramps, and the classes of whom we have recently heard so much in Kent, is undoubtedly one of the most dangerous forms of pollution. Fresh human excrement he had always regarded as more dangerous than any other kind of manure. Manure diluted with less objectionable matters, which has generally undergone changes which have resulted in the destruction of a large proportion of the organisms so inimical to the human race. Hop-pickers are limited to a few counties, but all counties are liable at certain periods to incursions from certain nomadic people. He was engaged in a county where, in the summer and autumn, a great many people are temporarily employed, and for whom accommodation is not always provided by the employers. and so long as it is not provided we must run the risk of our wells and streams being polluted from this cause. His experience led him to admit that the making of by-laws for regulating the sanitary conditions of such encampments has been much neglected, and that in many districts where by-laws have been framed, the difficulties of enforcing them have seemed almost insurmountable. More could be done than has yet been attempted. The provision of latrines and of easily accessible supplies of water should be always enforced. It is

true, as we have recently found urged in Kent that the sanitary authorities may compel latrines to be provided, but they cannot compel the people to use them, still if one portion of the population cannot be got to do its duty that is no excuse for another not doing it. Whether sanitary conveniences are provided or not, every possible precaution should be taken to prevent people of these classes from having access to the source of a public water supply. There should be "protective areas" around all sources of supply, every spring or well used for domestic purposes being properly safe-guarded. Hitherto water companies and sanitary authorities have been allowed merely to acquire springs and sites for wells, but they should be compelled to acquire sufficient of the land around in order to obtain such a control as would effectively prevent pollution. My friend, Mr. Whitaker, also suggests a "protected area," but he uses the term in a different sense. My sense is that the acquisition of such "protective areas" should be made binding on all water authorities, and, in the future probably, this will always be insisted on. We should follow the example of Glasgow, and obtain control of the whole water shed. The conditions of different sites vary so much that no general rule can be adopted. In determining a site many factors will have to be taken into account, the depth and nature of the sub-soil, the height of the ground water, and the fluctuations due to season and to pumping. Had there been a reasonable protective area around the springs at Tutsham, almost certainly the Maidstone epidemic would not have occurred. The Maidstone and Lynn outbreaks will serve to direct increased attention to the immense stores of underground water, in strata naturally protected from pollution by thick impervious layers of clay, but water, even from such a source, may become contaminated, unless proper precautions are taken. County Councils could do much, he thought, to protect the population. He had within the last few days presented a report on the protection of water supplies to his County Council and had asked them to consider whether they could not do something towards safe-guarding the public. No sanitary authority or water company with satisfactory sources of supply would reasonably object to their being examined periodically by a competent person. Neither would any authority or water company really anxious to safeguard their supplies object to such inspection. The examination of the sources of water is much more important than any analysis. He did not mean to say that analyses of water were unnecessary, for occasions do occur when an analysis will reveal pollution which had previously been unsuspected. His recommendation was the provision of a protective area round every source of water supply, inspection at regular intervals say once a year, and analyses every quarter or every month or even oftener according to the importance of the supply. Experience has taught us the necessity of striking while the iron is hot and he congratulated the Sanitary Institute upon the opportunity it had afforded them of discussing that important subject at so opportune a moment.

Dr. CHARLES PORTER (M. O. H., Stockport), said: At the Congress

at Newcastle in 1896 he had the honour of submitting a paper which contained suggestions for amended legislation on this subject. He embraced with pleasure the opportunity afforded by this discussion and the present healthy state of public opinion in regard to water-supply to bring again to the notice of the Institute what had been aptly christened by Mr. Ernest Hart "The autocracy of private water companies." He wished again to call attention to the unjust and anomalous condition of the law which, whilst it provides for the inspection of the premises and the goods of food vendors generally, leaves sanitary authorities (outside the Metropolis) without any similar powers of protection of their water-supplies, when in the hands of private companies. The sympathy and influence of the Institute would, he hoped, be enlisted in support of the endeavour to rectify this condition of affairs. An example of the existing disgraceful state of things was revealed by Dr. Bruce Low's recent report on the water supply of Horsforth, near Leeds, where water drained from land manured with night soil had been surreptitiously turned into the public mains by a water company, whose high handed conduct had culminated in the statement that they would not allow the sanitary authorities to interfere with the affairs of the company. He thought the time had come for further legislative action in this matter. He was here at the request of the sanitary authority he served to state that in Stockport they possessed no right of entry on the waterworks, and in the past he had been denied permission to take samples from the filter wells of individual filters and had been refused information as to the bacteriological investigations made by the company of their effluents. The sanitary committee had therefore recommended their Council to petition the Local Government Board to take the necessary legislative measures whereby every sanitary authority, supplied by a water company which is not also a sanitary authority, be empowered to authorise any duly appointed official to enter, inspect, inquire, and take samples at any part of any source or works of water-supply or water purification at any time, by day or night, and whereby also such water company be required to afford all reasonable facilities and information for such inspection, inquiry, and sampling. He hoped the Institute would accord its powerful support to this much needed reform.

The Rev. EMBERTON THOMAS (Vicar of West Farleigh) said Miss Chreiman's paper bears every mark of imperfect observation. No doubt there is in the arrangements made by the farmers of Kent a great want of sanitation, a want of pure water, and he thought Dr. Adams put this down to the right cause. There was no doubt the farmers of Kent had got into a sort of sleepy state and had an idea that this sort of thing might go on without bad results, but when we consider the masters' side we find there is much to excuse them. The hop-picking continues only some few weeks in the year and it is very difficult to provide in a proper way for those who are employed only for these three weeks. To fairly conduct an enquiry such as that

undertaken by Miss Chreiman requires the greatest consideration. He would point out one or two instances in which Miss Chreiman's paper was wrong. The statement was made that the hop-pickers came down to the fields weeks before the time. Besides the people who come for the hop-picking there are the van-people and tramps. Certainly the tramps who are going about the country all the year round come down before the hop-picking actually begins, but not the hop-pickers. They do not go before they are sent for by the farmers. When the hops are ready to be picked they send to London for the pickers and they commence picking next day. Then it was said the hop-pickers do not know what they are going to get for their work. It may be true of some parts of Kent but taking the county as a whole it is not true to say that they do not know what they are going to earn. The prices paid may vary within certain limits, according to the state of the labour market and from other causes, but they are usually told before they come down how many bushels they are to pick for a shilling. With regard to the Church of England Society it is not true to charge it with neglect of its opportunities. We have our mouths shut with regard to matters of sanitation. If we were to bring complaints on all these matters of order and management we should not be allowed to enter the hop-fields. We have our school rooms open every night where the hop-pickers play or otherwise enjoy themselves, and many farmers provide recreation for them at their own expense. He liked fair play, but it was not fair to take individual cases of an extreme character as representing the whole. By taking individual cases you cannot find out the true state of affairs. Much had been done towards putting matters right, and he trusted that by the letters in *The Times* and this discussion, that sanitation among the hop-pickers and the housing of these poor people would soon be improved.

Major Lamorock Flower (Sanitary Engineer to the Lee Conservancy Board): Much had been said during the discussion, he remarked, that he should have said. He knew he should have agreed with Dr. Fosbroke, and he would have said we must have compulsory not permissive legislation. In the district administered by the Board of Conservancy of the River Lee there were no hop-pickers, but they had peripatetic caterers for the amusement of the people who give local authorities a good deal of trouble wherever they come. The foremost necessity for all encampments temporarily occupied is a proper water supply, and there should be provided proper latrines, which, when the necessity for their existence has passed away, can be removed or filled in and covered over, and the ground left as before the occupation. He had risen because a reference had been made to the River Lee. He did not think they had there more typhoid than in in any other part near London, and he could bear testimony to the care taken by the sanitary authorities of his district to avoid pollution of the water.

Miss CHREIMAN (London) in reply to the discussion maintained the statement that the people went down from one to two weeks beforehand, and they do go down in large numbers much before the commencement of the hop-picking. The practice of measuring complained of was not "universal," but very general, and a constant item of bitter complaint by the pickers, and of regret by observing residents. In respect of the admirable by-laws, a copy of which had been handed up, she would like to be supplied with the addresses of any farms on which they are carried out. Her observations, though somewhat local, had been over an area served by some four thousand hop-pickers, in which such regulations most certainly did not prevail. Unquestionably, the pickers were a most difficult people to do with, or for, and assistance and support were required by those who had to do with them. Unfortunately, in order to save the time of the meeting, she had been obliged to omit the portions of her paper treating of the care of the missionaries and some of the farmers (notably Mr. White, of Paddock Wood) for the hop-pickers. The fact mentioned by Mr. Thomas that church workers did not complain of unsatisfactory arrangements, to avoid giving offence, was too true, their position was especially difficult. The whole circumstances of the barbarian "holiday" called most urgently for philanthropic and official remedy, and anyone thinking of such plea for reform as mere womanish sentimentality had her sincerest pity.

SIR DOUGLAS GALTON, in closing the discussion, said he had had a great deal to do with reports on the sanitation of India, and there were many complaints of water pullution much in the same way as by these people in Kent. No pictures from India could be more striking than these, which *The Times* and Miss Chreiman have described in Kent. In Australia, where they import a great many coolies, the importers are compelled to provide for their sanitation and care whilst employed, and for their re-shipment; and why not apply the same principle to the people in Kent, who derive so much profit from the hop-pickers?

LECTURES AND DEMONSTRATIONS TO SANITARY OFFICERS.

INTRODUCTORY LECTURE

To the Twenty-Fourth Course.

THE OUTCOME OF SANITATION.

By Louis C. Parkes, M.D., D.P.H., M.O.H., Chelsea.

(Fellow.)

One of the greatest—if not the chief—glory of the Victorian era has been the astounding growth that has taken place in the formation of exact knowledge as to the causes of many of the diseases that the human race is liable to, and the adoption of those measures, state, municipal, or private, that science and experience have indicated as being necessary to counteract the disease-tendencies, and agencies, by which the population is continually assailed. During the sixty years of the Queen's reign, and contemporaneous with it, there has been civil registration of births, marriages, and deaths; and an immense mass of material has been accumulated, which exhibits the vital statistics of the nation for each one of the sixty years of this eventful period. Not only are we now in possession of the facts as to the mortality from different diseases, and the ages at death, of the population during the last sixty years—factors which enable us to make comparisons between the health and longevity of the present day population and that of its progenitors; but owing to the immense studies made in the medical and allied sciences, we now recognise many of the direst diseases and worst scourges of the human race as preventable by properly administered methods of sanitation, and we have already gone a considerable way on the road to the perfecting and completing of such methods.

During the early years of the Queen's reign there was great indifference to health questions, not only amongst the populace

at large, but also in the responsible legislature and the government. This indifference was perhaps largely the result of ignorance, and of that tendency to regard disease manifestations as natural and uncontrollable, because of their very familiarity. Later on there came what has been termed the "great awakening," when the government of the country and also the more enlightened portion of the public, through the labours of Chadwick and the early band of sanitary reformers, had their eyes opened to the disgraceful conditions of filth, neglect, and misery, in which large masses of the urban population were existing, and to the part that these filth conditions played in the promotion of disease, early death, want, and destitution.

In the early years of the Queen's reign large masses of the population were living under conditions of absolute sanitary neglect. There were no health laws, no municipal rules or regulations; even in the few places where such existed, they were seldom or never enforced. The individual was a law unto himself, and studied merely his own convenience, and not that of his neighbours. The water for his house was obtained from the nearest shallow well, ditch, or pond; his refuse was deposited anywhere according to the dictates of his own fancy; and large numbers lived and died in squalid, overcrowded, and filthy tenements, and cellars in the slums of our great cities untroubled by sanitary inspectors and health officers.

All this, as you know, is now nearly, if not quite, a tale of the past. Public Health Acts, Sanitary Authorities, qualified Inspectors, and Medical Officers of Health, have caused such a revolution in the lives of the poor, that to be able to live under moderately healthy conditions is now the lot of the vast majority, and not the privilege of a favoured few. Along with the abatement of nuisances and the abolition of grosser filth conditions, have come along schemes for the continuous supply of pure water to large towns, schemes of sewerage, drainage, and disposal of sewage, schemes for re-housing the working classes in sanitary dwellings, the provision of infectious disease hospitals, and gratuitous disinfection of infected premises and clothing, not to mention many other improvements designed to ameliorate the conditions of life for the working population, to protect them from communicable diseases, and to shield them from accidents in factories and workshops.

Let us now contrast the death-rates in England of some of the more preventable diseases during the first five years of the Queen's reign, 1838-42, and during the five years, 1891-5.

Small-pox.—The death-rate from small-pox at all ages during 1838-42 was 576 per million living. In 1891-5 it was only 20 per million, a reduction of 96 per cent. Sixty years ago

vaccination was but little practised, inoculation of small-pox virus was still performed, and measures of isolation and disinfection were practically unknown. The reduction in small-pox mortality is greater than that of any other disease—even fever, and furnishes the very strongest kind of evidence that our modern methods of prevention by compulsory vaccination and isolation of patients are effective in controlling one of the greatest scourges the human race has ever been liable to. If effective, why disturb them? The onus of proof that these measures are ineffectual surely rests with those who would displace or nullify them.

Fever.—The death-rate from fever at all ages during 1838–42 was 1,053 per million living. In 1891–5 it was only 185 per million, a reduction of 82 per cent. Typhus and enteric fever are the two diseases which furnish the great majority of the deaths certified as due to fever. It is only since 1869 that the Registrar-general has distinguished these two varieties of fever in his reports, so that we are unable to say what is the precise reduction in each disease at the present time as compared with the early years of the Queen's reign. Since 1871–5 there has, however, been a reduction of 95 per cent. in the typhus death-rate, and we shall be justified in assuming that compared with sixty years ago typhus has almost ceased to exist in England. As regards enteric fever there has been a reduction of 53 per cent. in the death-rate since 1871–5. It seems certain that the improvement as regards enteric fever and typhus mortality has been very much greater during the last twenty than during the first forty years of the reign. It is not much longer than twenty years ago since the first Public Health Acts came into operation. Typhus and enteric fever are pre-eminently the diseases which flourish where sanitation is wanting or rudimentary. Typhus is closely associated with dirt, overcrowding, want, and destitution; enteric fever has intimate relation to polluted water supplies, polluted soil, and retention of excretal filth in or around dwellings. The sanitary measures of the last twenty years have been aimed particularly at the removal of these unhygienic conditions. Cholera, too, has met with a similar fate to typhus. This disease, imported from Asia, ran riot through the country in the forties and fifties, and to a lesser extent in the sixties. The poison of this dread disease was undoubtedly introduced into England on several occasions in 1892, 3, 4; it even caused an outbreak at Grimsby in 1893, yet no epidemic occurred in the country at large, which, generally speaking, was prepared to receive and deal with it.

Scarlet Fever and Diphtheria.—Prior to 1859 these diseases were tabulated under a common head. In 1838–42 the joint

mortality was 797 per million living; in 1891–5 it was 435 per million, a reduction of 45 per cent. Since 1861–5 the scarlet fever death-rate has been reduced 81 per cent., but the diphtheria death-rate is now very much the same as it was thirty years ago (1861–5), and is about double the rate prevailing in the fifteen years 1866–80. Whilst there can be little doubt that improved social and sanitary conditions have played some part in the reduction of the scarlet fever death-rate, still the larger portion of the diminished mortality is probably attributable to a change in the type of the disease. Scarlet fever, as now seen, is a disease of milder type with less proneness to terminate fatally than it was thirty years ago.

In the increase of diphtheria in recent years, more especially in many of the large towns of England, we see the reverse side of the picture. It would take too long to discuss the causes of this increase; as a matter of fact we do not know exactly what they are, and can only speculate upon probabilities. It seems, however, that sanitary improvements, as such, have had little or no effect upon the behaviour of this disease. The exciting cause is now known to be a bacillus, but we know little of the conditions—the predisposing causes—which favour the growth or virulence of the bacillus either inside or outside the human body, or facilitate its transference from sick to healthy—conditions which must be studied if we are to ascertain why it is that diphtheria has made certain large centres of population its abiding place, and in its endemic homes assumes at times epidemic proportions. There is undoubtedly some connection between elementary school attendance as now carried out and diphtheria prevalence, but the relation is not a very simple one, and is incapable of explaining all the facts of increased diphtheria incidence on urban populations.

Of the other specific diseases of the Zymotic class it is sufficient to say that the death-rate of *Measles* has been reduced 24 per cent. during 1891-5, as compared with 1838-42, whilst the *Whooping-cough* death-rate has been reduced 21 per cent. These diseases are chiefly fatal in the first three years of life. The types of these diseases, as far as we know, have not altered; and the effect of improved social and sanitary conditions in reducing the death-rates is most probably in giving the sufferer a better chance of recovery in case of attack, rather than in diminishing the prevalence of either disease. Epidemics of measles and whooping-cough are as common now as they were when the Queen came to the throne.

During the thirty-four years from 1847 to 1880 the average death-rate from *Diarrhœa* was over 900 per million living. In 1891-5 it was 630 per million, so that there has been recently

a 30 per cent. reduction as compared with the rate prevailing prior to 1880. This disease is one which exerts its fatal effects chiefly upon infants and young children, and is largely due to improper feeding of hand-fed infants, to dirty homes, and maternal neglect. With the growth of education, with the higher wages now prevailing, and the better sanitary condition of the homes of the working classes, a greater reduction in the mortality from infantile diarrhœa might have been expected. The prevailing rate is highly suggestive of the fact that the hygiene of the nursery is but little understood—or, at any rate, practised—by working-class mothers.

Tubercular Diseases.—In 1838-42 the death-rate from Phthisis (consumption) and other tubercular diseases was 3,959 per million. In 1891-5 the death-rate from these diseases was only 2,124 per million—a reduction of 46 per cent. Overcrowding in dwellings, workshops, and factories, damp and dirty houses, a water-logged subsoil, and working in dust-laden atmospheres, are well known as the exciting causes of consumption. In young children there is probably another cause at work producing abdominal tuberculosis, namely the consumption of milk from tubercular cows. It is satisfactory to find that so considerable a reduction has taken place in the death-rate from this disease, which hurries to an early grave so many in the spring time of life; but much remains to be done.

Cancer.—Cancerous diseases would appear to have increased considerably during recent years, but the increase is probably more nominal than actual, owing to improved methods of medical diagnosis, and increased precision in certification of the causes of death. In 1861-5 cancer caused 386 deaths per million living, and in 1891-5, 712 deaths per million—an increase of 93 per cent. It is difficult, however, to believe that all this increase is nominal, and that none of it is due to a greater prevalence of malignant disease.

Malarial Diseases.—In the early years of the Queen's reign, ague, intermittent and malarious fevers were very common in the fen counties and other swampy districts. Arterial land drainage and cultivation of the soil have now nearly eradicated ague and its congeners, even in districts where they were formerly commonest.

Of other diseases of the preventable class, such, for example, as those due to alcoholic intemperance, it is impossible to speak with certainty. But few people die of acute alcoholism; a great many die of the effects more or less remote of prolonged alcoholic indulgence; but the diseases which kill them—affections of the liver, stomach, kidneys, and brain—are not entered on the death certificates as being primarily the result of alco-

holism. Only those who die of acute alcoholic poisoning are recorded as being the victims of intemperance, and judging by this class alone, nearly twice as many lose their lives now through drunkenness as perished in a similar manner twenty to thirty years ago. Against this fact, however, must be set the undoubted certainty that the people of England are far more temperate now in their habits than they were early in the reign; and that if drinking still prevails to a regrettable degree, it is for the most part conducted within the bounds of decorum and discretion, so far at least as regards its effect upon personal conduct and behaviour.

There is one class of diseases, which I should have preferred to pass over in silence, but which in my position as a medical man and a responsible health officer, I feel it my duty to include in the brief review I have been sketching. The mortality indirectly resulting from the infection of syphilis is not accurately known even to medical men, and may be searched for in vain in the national statistical records. The public do not know, and have never realised, the far-reaching nature and inexhaustible energy of the virus of this disease. Even now, pathology is teaching us that certain forms of insanity and several of the most fatal but obscure diseases of the nervous system are the results of the long previous inoculation of the virus of this disease. Add these new discoveries to the knowledge of older date as to the havoc wrought in the system by syphilis and its hereditary transmission to the offspring of affected parents, and there are few qualified to give an opinion who would hesitate to affirm that this complaint is the most insidious of any to which man is liable. The revelations which have lately been made as to the horrible condition in which so many young soldiers have been invalided home from India, and discharged superficially cured, but still too often incurably affected, to be merged in the civil population, are too recent to require more than a passing mention. The horrible evil that has resulted from the abolition of all control by the military authorities both in India and elsewhere over contagious diseases of this class, could only be adequately depicted by the pen of a Zola. The mistake, the fatuity, that has been committed by weakly surrendering to the noisy and prurient sentimentalism of irresponsible faddists has now in some measure been recognised, chiefly perhaps owing to the fact that the efficiency of the Indian Army as a fighting machine was becoming very seriously impaired by the ravages of this disease.

Let us turn now to some facts and figures relating to the general birth-rate and death-rate of the country, and the mean length of life during the Queen's reign.

ENGLAND AND WALES.

Years.	Persons Married, or Marriage-rate.	Birth-rate.	Death-rate.
1841-50	16·1 per 1000	32·6 per 1000	22·4 per 1000
1851-60	16·9 „ „	34·1 „ „	22·2 „ „
1861-70	16·6 „ „	35·2 „ „	22·5 „ „
1871-80	16·2 „ „	35·4 „ „	21·4 „ „
1881-91	14·9 „ „	32·5 „ „	19·1 „ „
1891-5	15·2 „ „	30·5 „ „	18·7 „ „

From the above table it will be seen that the number of persons married in 1891-5 was nearly 1 per 1000 lower than in 1841-50. The marriage-rate was highest (16·9) in 1851-60, and steadily declined from that decennium until 1881-90, when the lowest rate (14·9) was reached. It has slightly risen again in the last 5 years. The marriage-rate is, no doubt, influenced to a considerable extent by trade prosperity; but the material prosperity of the bulk of the nation must be greater now than it was in 1851-60, and yet the marriage rate has fallen 1·7 per 1000. This decline must be due, not to lessened prosperity, but to an alteration in national manners and customs. The fact probably is that the working classes have now, and also expect when starting in life, a higher standard of comfort than satisfied their predecessors of 40 years ago. Early and improvident marriages are less recklessly entered into; and on the whole the alteration is probably a sound one.

The birth-rate of 1891–5 is 2·1 per 1,000 lower than it was in 1841–50. The highest rate was reached in 1871–80, a period of great commercial prosperity. The decline since that period of nearly three per 1,000 is very marked. It will be noticed from the Table that the period of highest birth-rate does not correspond with the period of highest marriage-rate, and that although the marriage-rate has risen slightly in the last quinquennium as compared with 1881–90, the birth-rate has declined 2 per 1,000. It would take too long to discuss the social and economical reasons for these variations in rate; it will be sufficient to know that the birth-rate of the country has steadily declined since the year 1876, when it was 36·3 per 1,000, and the highest recorded rate of any year since civil registration began (1839), and that the marriage-rate fell continuously from the year 1873 (17·6 persons married per 1,000) to the year 1886 (14·2 per 1,000), but has since risen again.

There has been a marked decline in the death-rate of the country. In 1891–5 the rate was only 18·7 per 1,000, as compared with 22·4 per 1,000 in 1841–50. It will be seen from

the Table that the death-rate of the country was practically stationary for thirty years (1841–70), but that since that time there has been a continuous diminution. The lowest recorded rate of any year since civil registration began was 1884, namely 16·6 per 1,000. The death-rates of the four years, 1890–1–2–3 were raised by the prevalence throughout the country of epidemic influenza.

The diminution of death-rate has been proportionally much greater amongst the town dwelling populations than amongst the country people. In 1861–70 the town districts death-rate was 24·8 per 1,000, and the county districts 19·7, a difference of 5·1 per 1,000. In 1891–5, however, the town rate was only 19·5 and the country rate 17·3, a difference of only 2·2 per 1,000, or less than half the difference prevailing thirty years ago. This probably means that sanitary improvements, which were, however, most needed in the towns, have been undertaken with greater vigour and thoroughness in urban than in rural districts.

For the facts relating to mean length of life and survival at different ages, we must consult the Life Tables for England. There is the life table for 1838-54, founded on the vital statistics of those years. There is also a life table for 1871-80, and another for 1881-90. Now, we find from the life table for 1838-54—the first seventeen years of the Queen's reign—that out of 1,000,000 male children born in that period, 646,502 only would survive to reach manhood, or 21 years of age; and similarly out of 1,000,000 female children born, 668,345 would reach 21 years. In 1881-90, however, 709,136 male children would reach 21 years, and 740,681 girls would survive so long —a difference of an additional 62,634 males and 72,336 females reaching adult age, and becoming useful citizens in 1881-90 as compared with 1838-54. The actual saving of life may be expressed in this way:—During the ten years 1881-90 some 600,000 persons (boys and girls) reached 21 years of age, who under the conditions of life prevailing early in the reign, would have met their deaths before they attained the age recognised by the law as conferring full responsibility on the individual. Contrasting 1881-90 with 1871-80 we get a similar but smaller result. In 1881-90 313,000 boys and girls survived to reach 21 years of age, who under the conditions prevailing in 1871-80 would have disappeared during their minority. It must not be thought that these rescued young men and women, having reached 21 years, promptly succumbed. That is not so, for each one of the men could look forward, on reaching his 21st birthday, to living 39½ years longer; and each one of the women to a further period of 41½ years of life. Those are the

periods on which their premiums would have been actuarially calculated, had they, on reaching 21 years, sought to insure their lives in first-class insurance offices.

Now, although there was this great saving of life in 1881-90 as compared with the previous ten years, 1871-80, it must not be supposed that the population was increasing much faster in the former period than in the latter. As a matter of fact, it did not increase so rapidly owing to the lower birth-rate (2·9 per 1000 lower in 1881-90 than in 1871-80). If the same birth-rate had prevailed in 1881-90 as actually did prevail in 1871-80, there would have been 794,143 more births in the ten years; and of these 794,143 infants born, 575,681 would have survived to reach 21 years of age. So that the addition to the adult population resulting from the lives saved in 1881-90 as compared with the former period of 1871-80, is over a quarter of a million less than the addition that would have accrued had the 1871-80 birth-rate been continued during 1881-90.

The great saving of life shown by the 1881-90 Table is not confined to the period of infancy and youth. As a matter of fact, out of a million children born at the present day, there are a larger number of survivors at each year of age up to 79 years for males and 89 years for females, than would have survived under the old conditions prevailing 50 to 60 years ago. There has been an immense saving of life in recent years up to ages, which embrace practically the entire lifetime. Although out of a given number of children born, more survive now and reach an advanced age than formerly, individual life is not lengthened. Individual life is shorter now after reaching a certain age, both for men and women, than it was earlier in the reign. After the age of 26, a man's prospect of life is actually less now than it was 50 years ago; and similarly for a woman after the age of 44 years. Stated briefly, the cause of this alteration in individual lifetime appears to be that by improved sanitary surroundings the lives of infants and children have been saved which were formerly sacrificed, thus increasing the expectation of life during childhood and youth. After reaching the adult age, however, males are now subjected to conditions which are not more favourable to life—probably less so, from increased competition and the nervous exhaustion thereby engendered—than existed 50 years ago; and this, together with the fact that some of the lives saved in childhood are unhealthy ones, which would have perished under the old sanitary conditions, account for the expectation of life being now actually less for those over 26 years of age, than was the case half a century ago. With regard to the shortening effect

upon life of the strain and stress of modern competition and the feverish anxiety of the commercial classes to grow rich or do better than their neighbours, it is a significant fact that the mortality produced by diseases of the circulatory system has increased more than 50 per cent. during the last 30 years; and it is well known that the heart as well as the brain is most injuriously affected by the nervous exhaustion consequent upon overwork, worry, anxiety, and dissipation.

Females as a class, not being subject to the same conditions as males, and living more at home, are saved much of the stress due to exhausting modes of life. The modern woman's expectation of life up to the age of 45 years is better now than it ever was; after 45, however, the unhealthy lives saved in infancy begin to influence adversely the expectation of life, but the age at which this occurs is put back nearly 20 years later than is the case for males.

It has been said that our modern methods of sanitary administration, of charitable hospitals, Poor Law relief, and general benevolence, whilst undoubtedly of incalculable benefit to the individual, looked at in a broader light, lead generally to the survival of the unfit, and national deterioration. They are said to be opposed to the evolutionary laws governing nature at large, which make for the survival of the fittest. This is no doubt to a certain extent true; but is it possible to avoid it? I think you will agree with me that it is not nowadays possible to refuse to apply for the benefit of our fellow-men that slowly acquired knowledge which enables the State to avert disease, pestilence, or famine; nor is it possible to disregard the moral instincts inculcated by education, and by refined and enlightened feeling, by which charitable effort is guided and influenced. In a more rudimentary condition of society before there was knowledge of the nature of disease, or education to arouse the dormant moral sense, wars, famines, and pestilences at times decimated the population, and many unfitted to cope with their enemies, human or microbial, paid the penalty of their unfitness. There was no doubt great individual suffering; but it is perfectly possible that these national misfortunes, as they were considered by the sufferers, tended by the elimination of the unfit and surplus population, for whom there was no adequate means of subsistence, to the perpetuation of a strong and virile race, capable of establishing an Empire over a large portion of the world's surface.

Are there any evidences of that latter-day national deterioration which the pessimists tell us of? It must be admitted, I think, that the evidence is of the frailest nature, but there are indications. There is that shortening of individual life of males

after reaching early manhood, when growth is but just completed. There is also the steady diminution in the birth-rate of the country, although the marriage-rate keeps up. With regard to this latter point it must be remembered that owing to the migration from country districts into towns, the urban population at the last census was nearly twenty-one millions, as against not much more than eight millions in the rural districts. In the early years of the Queen's reign the rural population was equal to, if it did not exceed, that of the towns. Many kinds of wild animal, we know, do not breed in captivity, and all degenerate in type when compelled to live under artificial conditions. Now although we can hardly consider man of the present day as a beast of the field, still life in cities, even the best ordered, is a less healthy mode of existence than that of the country labourer, who passes his entire day under the open skies; and the diminution in the birth-rate may be for us but the commencement of that process of decay and extinction, which very recent history shows that native races have undergone when brought under the baneful influences of civilisation.

The subject is an important and attractive one, but is too wide for me to enlarge upon to-night. It should, however, engage the attention of the more thoughtful of the community, and the government of this country ought certainly to leave no effort untried to check the depopulation of rural districts and the extinction of the old national pursuit of husbandry, which has in the past produced the men by whom the British Empire was founded. The ignorant and careless may think of the revival of agriculture as merely benefiting the farmer; but if it also prevents the swamping of our great cities with unskilled labour, and encourages the growth of a strong and hardy peasant population, it will be a great national benefit, for the degeneration of the race will thereby be indefinitely postponed.

Water Supplies.—At the commencement of the reign, the importance of a pure water supply was but little appreciated, and large numbers of people, both in town and country, were daily consuming water derived from suspicious sources, and undoubtedly at times grossly contaminated. Not only in the country, but also in many towns, polluted shallow wells were the chief sources of supply. Polluted rivers, streams, brooks, and even ditches and ponds were largely drawn upon to furnish water for human consumption, with results to the health of the population now appreciated, but in those times ignored. The enormous change that has taken place in this respect during the last 60 years is matter of common knowledge. All the principal towns of the country are now supplied with water of unexceptionable purity, as are also many rural districts, and

the millions sterling spent in these magnificent enterprises are amongst the wisest and most beneficial outlays of the country's wealth that can be conceived. Everywhere it is recognised that the water supplied to the community must be abundant in quantity and in quality, free from any trace of specific organic impurity. The great advantages to all classes of water consumers of a soft water as opposed to a hard, are not yet, perhaps, duly appreciated. It is surely an unscientific and wasteful proceeding to furnish a large population with water which encrusts boilers and pipes with lime deposit, which is unsuitable for cooking, and prodigal of soap. If soft water cannot be obtained in the neighbourhood of a town, at any rate means exist for softening hard water containing chalk in solution; and there can be no comparison between the cost of softening water on a large scale before distribution, and the enormous outlay required to remedy the ravages of lime deposit whenever hard water is brought to the boiling point—an outlay which has to be borne, more or less, by every individual consumer of a hard water. Whilst so much has been done to furnish to every one organically-pure water, there still remains to be discovered a suitable material of which the distributing water-pipes should be composed. It must be strong, and capable of resisting the disruptive force of high pressures; flexible, so as to be easily bent; capable of being strongly and easily jointed; and most important of all, must be chemically unassailable by water or substances often present in water, so that not only may the pipes be durable, but also that no poisonous matter may be introduced to the detriment of the consumer. Neither iron, lead, copper, block tin, tin-lined lead, cement-lined or vitreous-glazed iron pipes satisfy all the conditions mentioned above, and the preservative effects upon iron pipes of Barff's process of oxidation, or of Angus Smith's coal-tar solution, are not always satisfactory.

Sewerage.—Equal in importance to the great undertakings for the supply of water have been the municipal schemes of sewerage for removing and dealing with the waste refuse of the population. At the commencement of the Queen's reign such sewers as existed were intended chiefly for conveying away storm and surface waters, not house sewage at all. The excretal refuse and house waste waters were received into cesspools, privies, and midden-pits, from which the liquid filth percolated into the surrounding soil, whilst the solids were periodically removed in scavenger's carts. The nuisance thus engendered by retention of excretal filth in or around dwellings was terrible, but was patiently acquiesced in by nearly all classes of society

Modern schemes of sewerage aim at the rapid removal of all polluting liquids and excreta from the dwelling, and their conveyance in as short a time as possible to some spot remote from dwellings. Great success has attended the efforts of our municipal engineers in this direction. In well constructed modern sewers the sewage is conveyed away from the town in a comparatively fresh and innocuous condition. The problem of sewer ventilation is still, however, awaiting solution. We are not yet, indeed, quite agreed as to what is the best thing to do with sewers. Ought we to provide as many openings into them as possible so as to frequently renew the air traversing these underground conduits, or is it better to "bottle them up" as much as possible? Some years ago every one would have said that the first method is the correct one, and that a system of "bottling up," *i.e.*, non-provision of any openings for ingress or egress of air, would lead to driving sewer gases into the houses. But roadway gratings leading to the sewers are very often a nuisance, and very possibly also injurious to health; there are also objections to the carrying of sewer ventilating shafts up the sides or fronts of houses; whilst with the modern system of disconnection of house drains and ventilation of soil pipes, the dangers of sewer air being forced into houses are comparatively remote. In my opinion with well-laid modern sewers of self-cleansing properties free ventilation is not required. The local authorities should here and there, and chiefly in open spaces where houses are not in close contiguity, erect pipe shafts carried up 30 or 40 feet above the roadway, merely to relieve air pressure in the sewers, and prevent the forcing of house traps. Roadway gratings should be abolished, and shafts should not be carried up houses; the relief of air pressure in sewers is all that is required. The anomalous condition of things existing at present is most remarkable. The greatest precautions are taken in modern systems of house drainage to disconnect the drain from the sewer, and to prevent any entry of drain air into the house. As long as he remains indoors the modern householder is safe, but as soon as he steps out into the street he may be assailed by a puff of gas from a roadway sewer grating, which has the effect of nauseating him for the rest of the day.

The right methods of disposal and utilisation of sewage have been the subject of much controversy and experimentation, and it is only quite recently that we have come to recognise the part played by natural forces in the purification effected by the various processes of precipitation and filtration which are now in vogue. Not many years ago the idea generally prevailed that a large volume of sewage required a large area of land for its disposal, so as to produce an effluent of sufficient purity to pass

into streams. But sewage farms were found to be costly to acquire and expensive to maintain. The return obtained from the sale of sewage grown produce was an insufficient set-off against these expenses. At the present time sewage can be clarified by precipitation, and subsequently purified by filtration through artificially constructed filter beds (which are really cultivating grounds for the nitrefying organisms that effect the chief part of the purification) on an area of land which would be absolutely useless for crude irrigation.

Local sanitary authorities are now alive to the necessity of purifying the sewage of their towns before discharging it into rivers, and very much good work has been done in this direction. The chief offenders in the pollution of rivers are now, as they have always been, the manufacturers. It is certainly not always easy to devise a plant which shall be effective in converting an inky black, greasy, and foul smelling waste liquor into a presentable fluid which will not contaminate the stream on the banks of which the factory stands; but it certainly seems as if the more adequate enforcement of penalties for pollution might have the effect of stimulating manufacturers to the recovery of many waste products which they now discharge into rivers to their very great injury.

House-drainage and Domestic Sanitary Appliances.—The advance that has been made in this department of hygiene during the past 20 years has been enormous. At the present time the art of house-drainage seems almost to have reached perfection; and it is difficult to conceive that the future will bring forth any very considerable changes in the methods now universally adopted. All this is very largely attributable to the teachings and expositions of two men, both of whom have been active supporters of this Institute since its first foundation. I allude to Mr. Rogers Field, M.Inst.C.E., and Professor Corfield, M.A., M.D. The principles underlying correct methods of house-drainage and sanitation, and the means by which these principles should be brought into operation, were expounded by Professor Corfield in his Cantor Lectures to the Society of Arts nearly 20 years ago, and by Mr. Rogers Field in the Model By-laws of the Local Government Board on House-drainage arrangements, which were issued to Sanitary Authorities in 1877. Owing to their labours, and to the work of others in the same field, the true principles of house sanitation have been very largely grasped, both by all those engaged in the building trade, and by sanitary inspectors throughout the country. It is remarkable how little deviation on the whole there has been from the true line of technical development in this branch of science. Patented systems of house-drainage

and proprietary articles of dubious sanitary value have, it is true, been from time to time brought out and introduced to the profession, the trade, and the public. But they have had only a small amount of patronage; and if it were not for the general ignorance of sanitation amongst architects as a body, they would have had even less.

At one time, I think, there was a tendency, especially amongst medical men and the upper classes of society, rather to exaggerate the dangers to health attributable to defective house drainage. Lately, owing to certain researches that have been made, which have been held to establish the innocuousness of sewer and drain air, there has been a tendency in certain quarters to decry the utility or desirability of modern methods of house sanitation. The difficulties in obtaining evidence that would convince a logician that defective house-drainage and various forms of ill-health and disease stand in the relation of cause and effect, are no doubt very great; but to those who have opportunities of observation there can be no question whatever that there is such a relation, when allowance is made for the undoubted fact that individuals vary enormously in their powers of resistance to septic influences, and that not only is there this difference of susceptibility in different individuals, but that even the same individual is at times more vulnerable than at others, much depending on his state of health and personal surroundings.

At any rate there are few who will be disposed to deny that the improved sanitation of dwellings has been productive of much good. Not only has there been a great improvement in the public health, some part of which is undoubtedly attributable to the better sanitation of our houses, but there has also resulted an improvement in the habits of the people—a greater regard for cleanliness and decency, greater sobriety amongst the adults, the influence of a cleanly and comfortable home counteracting the attractions of the public-house; and the educational value to the children of cleanliness and order in place of dirt, neglect, and indifference has had the most far-reaching consequences.

REVIEWS OF BOOKS.

"AN INQUIRY INTO THE RELATIVE EFFICIENCY OF WATER FILTERS IN THE PREVENTION OF INFECTIVE DISEASE."*

This inquiry formed the subject of a special report to the *British Medical Journal.* The first part dealing with non-pressure filters (Table, Pocket, and other portable forms) appeared in the *British Medical Journal* of November and December, 1894. The concluding portion, which treats of pressure filters, has just been published by the same Journal (January 22nd, 1898).

In the first part of their report the Authors demonstrated that out of twenty-one filters (domestic) submitted for examination by twenty-one manufacturers—including all those most largely advertised and sold in this country—only three, namely, the Pasteur-Chamberland, the Berkefeld, and the Porcelaine d'Amiante Filters afforded any protection against the communication of water-borne disease (cholera and typhoid fever). As regards these three latter, however, the rate of filtration was so slow, when used without pressure, that the authors recommended their employment as tap or pressure filters, wherever possible, it being essential that a sufficient supply of filtered water should be available to subserve *all* domestic purposes.

Part II., therefore, of the inquiry is devoted to an examination of the properties of these and other filters of similar character, as regards protection against the communication of water-borne disease, when used under pressure, with a comparatively rapid rate of filtration. The filters of twelve manufacturers were examined. Six are unfavourably reported on, and six favourably. The latter includes the three which were found to be satisfactory as non-pressure filters, also the Pukall filter (unglazed porcelain) manufactured by the Royal Porcelain Factory of Potsdam; an unglazed porcelain filter by Slack and Brownlow; and a natural stone filter (Duffs') (agents, Witty and Wyatt Ltd.).

None of these filters, when continually used, sterilise the water. For a day or two the filtrate is sterile (devoid of all microbial life): but after a short period varying with the closeness of the pores of the filter, and the temperature of the water, certain aquatic organisms actually grow through the minute sinuous passages of the filtering medium, and consequently appear in the filtered water. This is not, hygienically speaking, a matter of concern, as those aquatic organisms that are able to grow through the filter, are perfectly harmless. Certain of these organisms in their growth through the pores of a Chamberland filter (taking four days at 18° C.) appear to undergo

* By G. Sims Woodhead, M.D., F.R.S.E., and G. E. Cartwright Wood, M.D., B.Sc.

attenuation or devitalisation, for they do not exhibit quite the same characteristics in the filtered as in the unfiltered water. The Berkefeld filter, which is more readily permeable than the Chamberland filter, does not appear to exert a corresponding influence on the microbes which grow through it, the rate of growth also being more rapid.

Under all ordinary circumstances typhoid and cholera organisms will not grow through the pores of these filters. It was found, however, that the addition to the water to be filtered of even such a small quantity as one-fiftieth of its bulk of meat broth sufficed to permit the growth of both cholera and typhoid organisms through either Berkefeld or Chamberland candles into the filtrate, on the 2nd, 3rd, or 4th day, if the temperature of the water was about that of the room 50° to 60° F. The filters so contaminated did not clear themselves of disease germs for several weeks afterwards—that is to say for several weeks after the introduction of the broth and organisms, cholera or typhoid bacilli could be found in the filtrate. Interesting as these experiments are, however, they have not much practical bearing, as it was found that neither polluted water taken from the Thames at Waterloo Bridge, nor even crude London sewage, supplied the requisite kind or quantity of nourishing material to the organisms which the broth contained, and by which the organisms were enabled to grow through the pores of the filtering media.

As regards other organisms present in polluted waters, which are pathogenic to animals, and which may be thought of as possibly having some relation to diarrhœal illness (especially summer diarrhœa and English cholera) in man, the researches of the authors show that these filters, and probably all those which prevent the direct passage of test organisms, exert a most remarkable modifying influence on the toxin-producing capacity and virulence of the fluids which they filter. Noxious waters of this class would be practically bereft of their harmful properties by this kind of filtration. But here again, the very close grained filters like the Pasteur Chamberland (and probably the Porcelaine d'Amiante filter in which the clay is mixed with finely powdered asbestos) exert a much more effective modifying influence than filters of the Berkefeld type, in which a compressed diatomaceous earth is used—this material being of a more porous character than porcelain.

On the whole we may conclude from these most valuable and interesting researches, that for practical purposes there is not much to chose between the six different filters that prevent the direct passage of test organisms. Where the water is generally of good quality (as in London and most of the towns of this country) a rapid delivery filter of large output is as safe as any of the more perfect filtering forms, and has the great advantage of rapid filtration. Where, however, a water is of inferior quality generally or at certain seasons, rapid filtration should be subordinated to the greater safety ensured by the use of the more impermeable material.

L. C. P.

SOILS AND SUB-SOILS FROM A SANITARY POINT OF VIEW, WITH ESPECIAL REFERENCE TO LONDON AND ITS NEIGHBOURHOOD.*

Sir Archibald Geikie, who writes the preface to this admirable treatise, states that at the office of the Geological Survey constant enquiries are made by the public for information regarding sites for houses and other questions involving the practical application of Geological Science. In view of this great and ever increasing demand for advice, it seemed desirable to put in a popular and accessible form a summary of what is known as to the relation of Soils and Sub-soils and the sanitary requirements of the community, and to select for the purpose of illustrating the subject, the district of London and its suburbs. Accordingly Mr. H. B. Woodward, F.R.S., has prepared the present treatise.

The treatise contains besides an introduction, chapters upon the Soils and Sub-soils of London and its neighbourhood, upon the Sub-soils with reference to sites and foundations for houses, upon water supply and drainage, upon sanitary considerations with regard to the sanitation and surroundings of houses, and upon cemeteries.

The area embraced in the treatise includes the whole of Greater London and some miles beyond, so that the nearer residential suburbs are considered.

Some useful tables are to be found in the text, notably in reference to geological formations and soils, and their characters arranged in order of their natural sequence or period of formation, another showing the depth of various Sub-soils in various places, and another enumerating the various cemeteries in and around London, and the soils in which they are situated.

Some eighteen woodcuts illustrate the press, the cuts being fully described and lettered; in addition, there is an excellent map extending from sixteen to twenty-four miles round London, on which the various Sub-soils are printed in colours and lettered.

To complete the work a full index is appended, in which most places mentioned have attached to them in figures the height of each locality in feet above ordnance datum, and also the geological formations found locally, in addition to reference numbers to the pages in the text.

Altogether this treatise forms a most useful, interesting, and instructive geological guide especially to residents in London and its environs.

J. F. J. S.

---

* By H. B. Woodward, F.R.S. Memoirs of the Geological Survey of England and Wales. Eyre and Spottiswoode, 1897. 58 pp., Royal 8vo. Price 2s. 6d.

ABSTRACTS OF TITLES IN BRITISH AND FOREIGN JOURNALS.

Sanitary periodicals both English and Foreign have now become so numerous that it is almost impossible for anyone to keep himself acquainted with the various subjects dealt with in them from time to time. In addition to this a number of articles of interest to Sanitarians frequently appear in journals not directly devoted to the subject of Hygiene.

In order to meet this difficulty the Council of the Sanitary Institute have after careful consideration adopted a scheme for publishing in the Journal of the Institute a list of titles of articles on subjects connected with Public Health, appearing in the various British and Foreign Journals and Transactions. In this list the titles of the articles, the name of the periodical, the place of publication, and a brief indication of the scope of the article will be given. The titles noted will be classified under the following headings.

Architectural Construction.
Bacteriology and Pathology.
Chemistry and Physics.
Domestic and Personal Hygiene.
Sanitary Engineering, Municipal.
Sanitary Engineering, Domestic.
Meteorology and Geology.
Naval and Military Hygiene.
Occupations and Industries.
Sanitary Administration.
Vital Statistics and Demography.

Arrangements have been made under which the following Journals and Publications will be perused for articles coming within the scope of the above scheme.

British.

British Medical Journal. Weekly.
Builder. Weekly.
Engineering. Weekly.
Indian Engineering. Weekly.
Journal of Gas Lighting, Water Supply, and Sanitary Improvement. Monthly.
Journal of Pathology and Bacteriology. Quarterly.
Journal of the Royal Institute of British Architects. Fortnightly.
Journal of State Medicine. Monthly.
Journal of The Sanitary Inspectors' Association. Monthly.
Lancet. Weekly.
Local Government Journal. Weekly.
Medical Magazine. Monthly.
Minutes of Proceedings of the Institution of Civil Engineers. Quarterly.

Proceedings of the Society of Chemical Industry. Monthly.
Public Health. Monthly.
Public Health Engineer. Weekly.
Reports of State Board of Health, Massachusetts. Annual.
Reports of British Association. Annual.
Reports of Local Government Board Inspectors.
Report of Medical Officer to Local Government Board. Annual.
Royal Engineers' Journal.
Sanitary Journal (Glasgow).
Sanitary Record. Weekly.
The Analyst. Monthly.
The Engineer. Weekly.
The Surveyor and Municipal and County Engineer. Weekly.
Transactions of the Epidemiological Society.
Transactions of Surveyors' Institution. Monthly.

AMERICAN.

American Medical and Surgical Bulletin.
The Engineering Record and Sanitary Engineer.

FRENCH.

Annales d'Hygiène Publique. Monthly.
Annales de l'Institut Pasteur. Monthly.
Annales des Ponts et Chaussées. Monthly.
Journal d'Hygiène. Weekly.
La Technologie Sanitaire. Monthly.
Revue d'Hygiène. Monthly.
Revue des Sciences Medicales. Quarterly.

GERMAN.

Archiv für Hygiene. Quarterly.
Berliner Klinische Wochenschrift. Weekly.
Centralblatt für allegemeine Gesundheitspflege. Monthly.
Centralblatt für Backteriologie v. Parasitenkunde. 2 vols. Yearly.
Deutsche Vierteljahrsschrift für Offentliche Gesundheitspflege. Quarterly.
Deutsche medizinische Wochenschrift. Weekly.
Gesundheits-Ingenieur. Fortnightly.
Hygienische Rundschau.
Veroffentlichungen des Kaiserlichen Gesundheitsumtes. Weekly.
Zeitschrift für Hygiene. Monthly.
Zeitschrift für Fleischn Milch-Hygiene.

The first list will appear in Part II. of the Journal to be published in July next, and it is hoped that it will be found of practical use to the members of the Institute.

ANNUAL REPORT OF THE COUNCIL

FOR THE YEAR 1897.

Read at the Ordinary General Meeting, March 23rd, 1898.

INTRODUCTION.

In presenting this Twenty-second Annual Report, the Council think that a record of work accomplished by the Institute during the year will be sufficient to show not only the growth of the Institute, but will also indicate the general progress which is taking place in the diffusion of Sanitary knowledge.

On the occasion of the Queen's Diamond Jubilee, a loyal and dutiful address was presented by the Council of the Institute, and was graciously acknowledged on behalf of Her Majesty. The wording of the address is given in Part II. of the Journal for the year.

SESSIONAL MEETINGS.

Sessional Meetings for the discussion of subjects of interest to Sanitarians were held in February, March, April, and December. These meetings afford an opportunity for an interchange of opinions amongst the Members and Associates of the Institute, and the Council will be glad to receive from time to time notice of any subjects which are thought desirable for discussion. During the year the following subjects were brought forward:—

"The Sanitary Supervision of Shelters for the Homeless." F. J. Waldo, M.A., M.D., D.P.H., Barrister-at-Law.

"Indian Sanitation." Baldwin Latham, M.Inst.C.E.

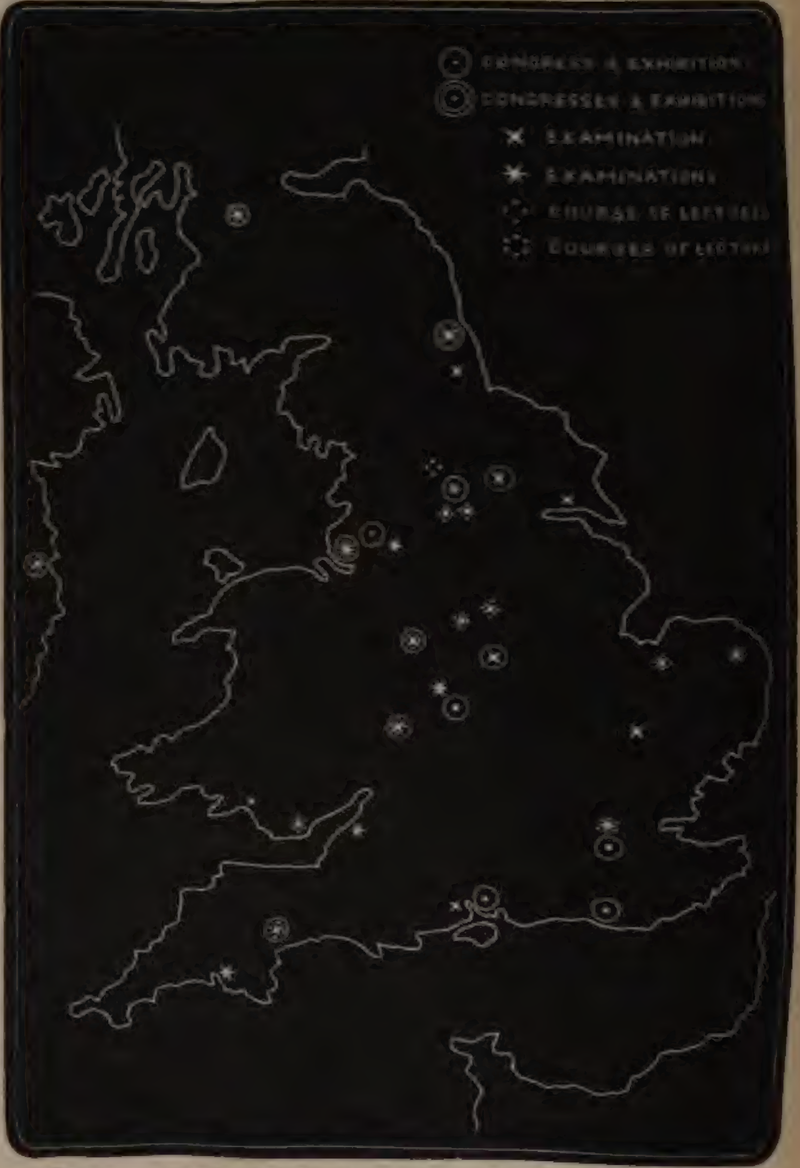
"The Notification of Measles." Henry Kenwood, M.B., D.P.H., F.G.S.

"The Pollution of Water Supplies by Encampments of Hop-pickers, Casual Workers, Tramps," &c. Prof. W. H. Corfield, M.A. M.D.(Oxon), F.R.C.P., in reference to the Dangers of Pollution of Municipal Water Supplies; Miss M. A. Chreiman, in reference to the Sanitary Control of Hop-pickers, &c.

The papers read during the earlier part of the year, with the discussions upon them, have already appeared in the Journal, Vol. XVIII. The papers by Prof. W. H. Corfield and Miss Chreiman will be published in Part I. of the Journal for 1898.

The attendances at the meetings varied from 60 to 150.

Map showing the various centres to which the work of The Sanitary Institute has been extended.



Congresses, 16. Examinations, 146. Courses of Lectures, 41.

LECTURES AND DEMONSTRATIONS ON SANITARY SCIENCE.

The twenty-third and twenty-fourth courses of Lectures and Demonstrations were held during the year in London. In February and March 64 Students entered their names, and in October and November 52 Students.

A complete list of the Lectures has been given in Vol. XVIII. of the Journal.

Technical Exhibitions are awarded by the Technical Education Board of the London County Council to the annual value of £5. which may with the approval of the Board, be applied to paying the expenses of students in attending these lectures.

INSPECTIONS AND DEMONSTRATIONS.

To make the course of training given by the Institute as practical as possible, arrangements were made for the Students to visit the places mentioned below in order that they might have the opportunity of observing and noting the difficulties that have to be met in the practical application of Sanitary principles to various trade processes. The names of the gentlemen who arranged the visits and conducted the students are also given :—

Artisans' Dwellings in the Boundary Street Area. By kind permission of T. BLASHILL, F.R.I.B.A. Conducted by OWEN FLEMING, A.R.I.B.A., Architect's Department, London County Council.

East London Water Works, Lea Bridge. By kind permission of W. B. BRYAN, M.INST.C.E., Engineer to the Company, who conducted the Students.

Friern Barnet Sewage Works. By kind permission of E. J. REYNOLDS, ASSOC.M.INST.C.E., Surveyor to the District Council, who conducted the Students.

Barking Sewage Outfall Works. By kind permission of J. E. WORTH, M.INST.C.E., District Engineer, London County Council, who conducted the Students.

Southwark and Vauxhall Water Works, Hampton. By kind permission of J. W. RESTLER, M.INST.C.E., Engineer to the Company.

Demonstration in Book-keeping, as carried out in a Sanitary Inspectors' Office in the Parkes Museum. ALBERT TAYLOR, Chief Sanitary Inspector of St. George's, Hanover Square.

Electric Light and Refuse Destructor Works, Shoreditch. By kind permission of E. NEWTON RUSSELL, ASSOC.M.INST.C.E., who conducted the Students.

St. Marylebone Stoneyard. C. J. KILGALLIN, who conducted the Students.

West London Paper Mill Co.'s Works. By kind permission of the Company.

Aylesbury Dairy Co. By kind permission of J. A. HATTERSLEY, Managing Director (2 inspections).

Ealing Sewage and Destructor Works. By kind permission of CHAS. JONES, M.INST.C.E., Engineer and Surveyor to the District Council (2 inspections), who conducted the Students.

Beddington Sewage Irrigation Farm, Croydon. By kind permission of THOS. WALKER, M.INST.C.E., Borough Engineer, who conducted the Students.

Express Dairy Company's Farm, College Farm, Finchley. By kind permission of G. TITUS BARHAM, Managing Director, who conducted the Students.

Wimbledon Sewage Works and Farm. By kind permission of C. H. COOPER, ASSOC.M.INST.C.E., Engineer and Surveyor to the District Council, who conducted the Students.

Knacker's Yard. By kind permission of HARRISON & BARBER (2 inspections).

Metropolitan Cattle Market. By kind permission of the Corporation of the City of London. W. A. BOND, M.A., M.D., D.P.H., Medical Officer of Health, Holborn.

Disinfecting and Filtering Appliances. By kind permission of, at J. Defries & Son's premises, Houndsditch, E. (2 inspections).

Disinfecting Station, Chelsea. By kind permission of LOUIS PARKES, M.D., D.P.H.LOND., Medical Officer of Health, Chelsea Vestry (2 inspections), who conducted the Students.

St. George's, Hanover Square, Sanitary Works in different stages of progress, Disinfecting Station, Mortuary, &c., Model Dwellings (Gatliff Buildings), and Routine Office Work of a Sanitary Inspector. By kind permission of the Vestry. Conducted by A. TAYLOR, Chief Sanitary Inspector (4 inspections).

London County Council's Common Lodging House, Parker Street, Drury Lane, by kind permission of the L.C.C. Conducted by FRANK J. RUDDLE, Estates and Valuation Dept., L.C.C. (3 inspections).

Richmond Main Sewerage Works. By kind permission of W. Fairley, Assoc.M.Inst.C.E., Engineer, who conducted the Students.

Disinfecting Apparatus and Model Steam Laundry. By kind permission of W. G. Lacy (2 inspections), who conducted the Students.

Demonstration of Diseased Meat in the Parkes Museum. W. A. Bond, M.A., M.D., D.P.H., Medical Officer of Health, Holborn.

During the period over which each course of Lectures extended the Students had the free use of the Library and Museum at all times when they were open, and special times were set apart during each week for the Students to examine the Museum with the assistance of the Curator.

The demonstrations of diseases affecting meat appear to be much appreciated by the students, and a cold storage chamber has been fitted up for the purpose of preserving specimens.

The Council desire to record their sincere thanks to the Lecturers for the great benefits they have conferred upon the Students, and for the assistance they have given to the diffusion of Sanitary knowledge by the preparation and delivery of these Lectures, and also to those gentlemen who took so much trouble to make the various inspection and demonstration visits instructive to the Students.

EXAMINATIONS.

In Practical Sanitary Science.

Examinations were held at the following places: London (2 Examinations), Birmingham, Bristol, Glasgow, Manchester, Newcastle-upon-Tyne, Norwich, Swansea, York. 58 Candidates presented themselves, to 26 of whom Certificates were granted.

For Sanitary Inspectors.

Examinations were held at the following places:—

Birmingham.	Manchester.
Bristol.	Newcastle-upon-Tyne.
Cardiff.	Norwich.
Glasgow.	Swansea.
London (2 Examinations).	York.

At these Examinations 505 Candidates presented themselves, and 255 were certified competent, as regards their Sanitary knowledge, to discharge the duties of an Inspector of Nuisances under the Public Health Act, 1875, or of a Sanitary Inspector under the Public Health (London) Act.

The Examinations were established in 1877, and the following figures show the total number of Examinations held, and the number of candidates :—

	Examinations.	Candidates Entered.	Candidates Certificated.
For Local Surveyors	35	291	142
Practical Sanitary Science....	15	159	83
Sanitary Inspectors	96	4,333	2,493
	146	4,783	2,718

A Table and Diagram relating to these Examinations is given on the opposite page.

A scheme before the Local Government Board for the formation of a Sanitary Inspectors' Examination Board, composed of representatives from various Societies, is still under consideration.

CONGRESS AND EXHIBITION.

The Sixteenth Congress and Exhibition of the Institute was held at Leeds, from September 14th to 18th, by invitation of the Right Hon. The Lord Mayor and Corporation.

Very suitable accommodation was provided for the meetings of the Congress in the Town Hall, Yorkshire College, Municipal Buildings, School Board Offices, Methodist New Connexion Hall, and the Albert Hall.

Delegates were appointed by 330 Sanitary Authorities, and by 76 Societies and Associations.

Seventeen meetings were held during the Congress, and at these 70 addresses and papers were read, and fully discussed.

Most of the papers and discussions are published in the Journal of the Institute.

A Conference of Municipal Representatives was added to the Congress for the first time at Leeds and proved satisfactory for discussing questions relating to Municipal Sanitation which are of interest to the delegates from the Sanitary Authorities attending the Congress.

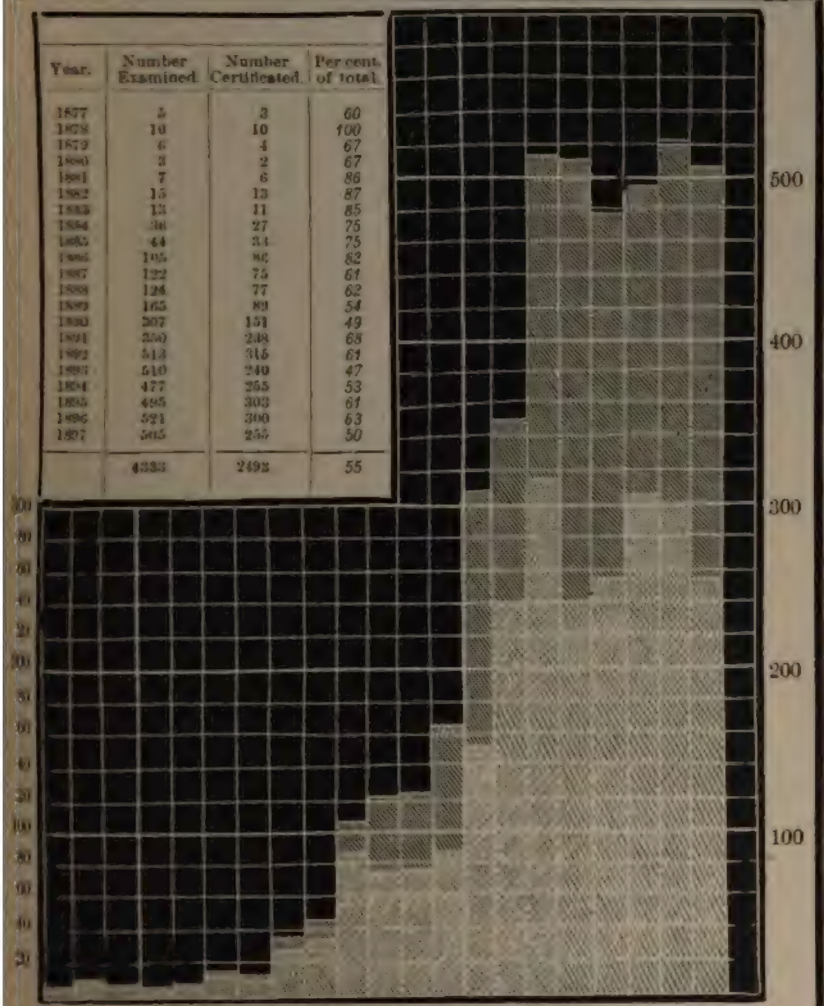
A resolution was passed recommending the Council to include this Conference in future Congresses. The Council decided to adopt the recommendation, and to arrange for the Conferences in future.

The numbers attending the Congress were as follows :—Members of Council, 22; other Members and Associates of the Institute, about 300; Associates of the Congress, 292; Delegates, 767; making a total attendance of over 1,380.

The Health Exhibition was held in the Smithfield Club Buildings

[T]able and Diagram showing the number of Candidates examined and certified each year. Relating to Inspectors' Examination only.

Year.	Number Examined.	Number Certificated.	Per cent. of total.
1877	5	3	60
1878	10	10	100
1879	6	4	67
1880	3	2	67
1881	7	6	86
1882	15	13	87
1883	13	11	85
1884	36	27	75
1885	44	33	75
1886	105	86	82
1887	122	75	61
1888	124	77	62
1889	165	89	54
1890	307	151	49
1891	350	238	68
1892	513	315	61
1893	510	240	47
1894	477	255	53
1895	495	303	61
1896	521	300	63
1897	505	255	50
	4333	2493	55



[N]OTE.—The total number of Candidates is shown by the whole height of the column shaded, and the number who have obtained Certificates by the lighter portion.

and was open twenty-three days. It was attended by [illegible] visitors. A list of the Exhibits to which medals were awarded, is given in Part III. of the Journal for 1897, and also a list of certain Exhibits which required special tests in London or elsewhere before their merits could be decided upon by the Judges.

An interesting feature in the Exhibition was the Demonstrations of the Röntgen X Rays and the Cinematograph. Among other Demonstrations and Competitions were Cookery, Physical Drill, Laundry Work, Dressmaking, and Modelling, in the arrangement for which the Institute was materially assisted by the co-operation of the Yorkshire Ladies' Council of Education, and the School Board Drill Instructor and Teachers.

Those who assisted have since received Letters of Thanks from the Exhibition Committee:—

Adams & Co., Park Lane Works, Leeds, for Gentlemen's Lavatory.

Doulton & Co., Lambeth, S.E., for Ladies' Lavatory.

Ingham & Son, for Loan of Drain Pipes.

F. Reynolds, for Fitting up Model Hospital.

Blind Institution, Leeds, for Exhibits of Baskets and Brushes.

G. W. Branson, for Lantern and Cinemetograph Displays.

British Institute of Preventive Medicine, 74, Great Russell Street, London, S.W., for Cultivations of Bacteria.

Claughton Bros., Bramley, Leeds, for Exhibits of Ornamental Lead Work.

Dr. W. L. Hunter, for Specimens of old Traps.

Noble Brown & Co., for Loan of Fire Appliances.

Reynolds & Branson, 14, Commercial Street, Leeds, for Exhibits of Models, Diagrams, Lantern Slides and Apparatus in relation to Physiology.

Shanks & Co., Tubal Works, Barrhead, N.B., for Specimens of Old Defective Work.

Miss Clare, for Assistance in Laundry Demonstrations.

Miss McCulloch, Superintendent of Cookery, Leeds School Board, for Assistance in Cookery Demonstrations.

Miss Peacock, Head Teacher of the Cookery School, for Assistance in Cookery Demonstrations.

Miss Watson, for Assistance in Judging at Cookery Competitions.

Head Teachers of Schools, whose Scholars took part in the Physical Drills.

A Table relating to these Exhibitions is given on the following page.

An illustrated list of the Exhibits to which awards have been given by the Institute at their various Exhibitions is published.

EXHIBITIONS HELD IN CONNECTION WITH THE CONGRESSES OF THE INSTITUTE.

	1877. Leamington.	1878. Stafford.	1879. Croydon.	1880. Exeter.	1882. Newcastle.	1883. Glasgow	1884. Dublin.	1885. Leicester.	1886. York.	1887. Bolton.	1889. Worcester.	1890. Brighton.	1892 Portsmouth.	1894. Liverpool.	1896. Newcastle.	1897. Leeds.	1898. Birmingham.
Exhibitors ...	117	116	189	106	110	126	134	135	130	112	108	108	156	146	100	145	
Exhibits ...	294	319	710	500	600	750	900	1,000	900	800	800	1,000	2,000	—	—	—	
Space occupied (in sq. ft.)	—	—	—	9,725	14,520	20,000	40,000	30,000	30,000 and Gr'nds	25,000	28,000 and Gr'nds	30,000 and Gr'nds	35,000 and Gr'nds	25,000	17,310 and Gr'nds	42,000	
Days Exhibition was open ...	14	16	17	19	25	25	19	17	26	29	23	18		24	22	23	
Total Visitors	—	—	—	8,955	8,373	20,000	35,000	37,000	30,000	27,000	23,000	35,000	49,000	48,189	51,000	75,790	
Medals awarded ...	13	13	12	12	15	21	18	34	16	14	30	32	21	29	61	55*	
Special Certificates ...	None.	6	9	7	4	13	11	11	12	9	None.	None.	None.	None.	None.	None.	
Certificates...	None.	22	38	40	72	58	83	79	64	40	71	88	76	56	None.	None.	
Exhibits deferred for further trial	—	7	52	30	37	44	39	119	42	46	67	67	38	59	44	26	

* These do not include the awards which may be given for Exhibits selected for further practical trial.

SANITARY LEGISLATION.

Very few Bills of a sanitary nature were introduced during the year.

The Parliamentary Committee of the Institute had before them and reported to the Council upon the following Bills. The action taken by the Council and the fate of the Bill is noted in each case:—

Plumbers' Registration Bill. Brought in by Mr. Knowles, Earl Compton, Mr. Dixon, and Dr. Farquharson.

This Bill, which was first introduced in 1892, was again brought forward. The Council petitioned against the Bill, and suggested amendments in Committee for the second reading: but the debate on the third reading was not concluded before the close of the session.

Rivers Pollution Prevention Bill. Brought in by Sir Francis Powell, Mr. Wyvill, Mr. Henry Hobhouse, Sir John Dorington, Sir Henry Howarth, Dr. Farquharson, Sir John Brunner, Mr. Kenrick, and Mr. Brigg.

A Bill to make more effectual Provision for prevention of the Pollution of Rivers and Streams. The Council petitioned in favour of this Bill, but suggested that the clause relating to solid matter in suspension should be so amended as to include this as a pollution. The second reading was not reached before the close of the session.

The following Bills were also considered, but the Committee reported to the Council that they did not contain provisions that made it desirable for the Institute to take any action in Parliament with regard to them:—

London County Council General Powers Bill.

Sale of Food and Drugs Bill.

Verminous Persons' Bill. This Bill was passed as *The Cleansing of Persons' Act*, the title having been amended in the House of Lords.

Local Authorities' Officers' Superannuation Bill.

PARKES MUSEUM.

The Lectures and Public Meetings held in the Museum have been well attended, and the daily visitors, who are admitted free, have been quite up to the average.

It is estimated that over 17,500 persons visited the Museum during the year.

Among the Institutions and Societies from which Classes attended during the year were the following :—

Aldersgate Street Polytechnic.
Architectural Association.
Bedford College.
Battersea Polytechnic.
Borough Polytechnic.
Bartholomew's Hospital.
Board School, Hampstead.
Board School, Lambeth Road.
Board School, Battersea.
Charterhouse, P. T. Centre.
Croydon Polytechnic.
Charterhouse School of Science.
City of London College.
Charing Cross Hospital.
Chelsea and Pimlico Nurses.
College of Preceptors.
Dame Owen's School.
Exeter Hall.
Finsbury Square Y.M.C.A.
Guy's Hospital.
Girls' High School, Dulwich.
Glengall Rd. School, Cubitt Town.
Green Coat School, Camberwell.
Hackney P. T. Centre.
Joint Examination Board, R.C.P. and S.
Kindergarten Training College, Stockwell.
King's College.
London Hospital Nurses.
London Northern Polytechnic.
S. B. L. Housewifery Sec.
Maria Grey College.
Military School of Engineering, Chatham.
National Health Society.
New Cross Institute.
North-East London Institute.
Polytechnic, Regent Street.
Post Graduates Course.
Physical Training College.
Surrey Square Board School.
South Norwood Polytechnic.
Southlands Training College.
St. Aloysius Convent.
Stoke Newington Science Centre.
Stepney P. T. Centre.
St. Thomas's Hospital Med. School.
St. Saviour's School, Herne Hill.
St. John Ambulance Brigade.
Thornton Heath Polytechnic.
University College, London.
Victoria Street Board School.
Westbourne Park Institute.
Wimbledon Technical Institute.
Working Women's College.

Table showing the number of Classes and Students visiting the Museum.

Date.	Institutions from which Classes attended.	Classes.	Students.
1892	13	68	854
1893	21	87	1043
1894	28	48	865
1895	50	93	1695
1896	49	82	1435
1897	53	138	1674

This Table shows an increasing use of the Museum for this purpose.

The Museum is recognised by the Science and Art Department in connection with their Classes, and the Class Visits paid by Students to the Museum may be counted as a Class attendance for the purpose of the Examination Grant.

Lantern Slides numbering 635 were lent on hire to members, and doubtless, as it becomes more known that these valuable helps for lecture purposes are available, the number of applications for them will increase.

LIBRARY.

Volumes and Pamphlets numbering 408 have been presented to the Library. Lists of these are published in Vol. XVIII. of the Journal.

About 300 references were made to the shelves by readers during the year.

For the convenience of Members, Associates, and Students who wish to borrow books for home reading, special arrangements have been made for the loan to them, at a small fee, of books from Lewis's Medical and Scientific Library, which contains a large number of recent text books and standard Sanitary works.

JOURNAL.

The Journal for the year contains the papers read in the Conferences at the Congress at Newcastle, and the Presidents' addresses, and papers read in the Sections at the Congress at Leeds. At the Leeds meeting the subject of Sewage disposal occupied a prominent place, and so much interest was expressed in the discussion that the Council decided to publish the several papers relating to the question in a separate volume. This was issued in November. The papers are also included in the Journal.

FINANCE.

The statement of accounts shows a steady increase in the receipts from subscriptions, and there is of course a certain increase in the working expenses corresponding with the growth of the Institute. It is satisfactory to note that the net cost of the Journal is less than last year, although a larger number of copies have been issued. The substantial balance of receipts over expenses in connection with the Exhibition, goes towards meeting the establishment charges of the Institute.

It should be remembered that no fees are paid for the professional services of either the Judges or the Examiners, and it is due to their self-denying labours on behalf of the Institute that the net result of the year's working leaves a balance of £859 to be carried to capital. The Council have increased the investments of the Institute by

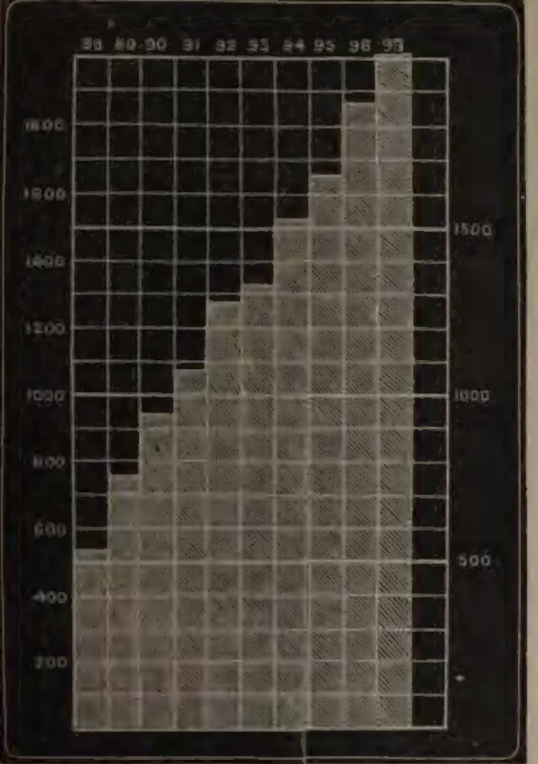
the purchase during the year of £1,000 India 3 per cent. Stock, and the total amount of assets, after deducting all outstanding liabilities, is £10,415.

EPITOME OF REGISTERS OF MEMBERS AND ASSOCIATES.

The comparison of the roll of the Institute with the preceding year shows a steady increase in the number of Members and Associates.

	Hon. Fellows.	Fellows.	Members.	Associates.	Total.
Dec. 31st, 1896	28	153	621	1064	1866
Dec. 31st, 1897	28	150	708	1142	2028

Diagram showing the Yearly Increase in the Roll of the Institute.



EPITOME OF THE WORK OF THE INSTITUTE, 1897.

London Lectures and Examinations.

		Total Attendance.
4	Sessional Meetings for discussion of Sanitary subjects ..	285
36	Lectures to Sanitary Officers	2,251
2	Special Demonstrations, Inspection of Meat	140
34	Practical Demonstrations for Sanitary Officers	925
2	Examinations in Practical Sanitary Science	34
2	Examinations Sanitary Inspectors	213
138	Classes brought to the Museum	1,674
	Other persons visiting the Museum *(Estimated)*	17,500

Provincial Examinations.

8	Examinations Sanitary Inspectors and Practical Sanitary Science	316

Congress and Exhibition at Leeds.

6	Sectional Meetings	706
8	Conferences	850
3	Addresses and Lectures	965
	Exhibition open for twenty-three days, at which a number of Lectures and Demonstrations were given	75,790

It will be seen from this general epitome what a large field the work of the Institute now covers, and the members will feel that good progress is being made in the Objects which the Institute desires to accomplish.

OBITUARY.

It is with regret that the Council have to report the death of Dr. Prosper de Pietra Santa, *Hon. Fellow;* Sir Henry Doulton, Surgeon-General W. R. Cornish and Mr. Ernest Hart, D.C.L., *Fellows;* H. C. Forde, M.INST.C.E., Il Signor Melisurgo Melissenos, G. A. Rogers, M.D., F. J. Mouat, M.D., F.R.S., Sir T. Spencer Wells, Bart., F.R.S., and G. Willis, M.D., *Members;* Alfred Amor, G. Dalton, A. J. Fairey, Walter Hughes, A. L. McDonald, *Associates.*

DOUGLAS GALTON, K.C.B.
Chairman of Council.

E. WHITE WALLIS,
Secretary.

March 9th, 1898.

STATEMENT OF INCOME & EXPENDITURE connected with Exhibition at Leeds, 1897.

Dr.

Expenditure.	£	s.	d.
To Printing, Postage, and Advertising	342	7	7
„ Catalogues and Programmes	173	2	3
„ Bands and Entertainments	456	10	6
„ Lectures and Demonstrations	130	3	9
„ Curator's Salary and Expenses	249	9	2
„ Wages	131	8	9
„ Incidental Expenses	80	4	7
„ Buildings, Fittings, and Decorations	215	16	2
„ Judging Expenses	322	15	2
„ Gas and Water	15	17	6
	2117	15	5
„ Balance	1016	9	2
	£3134	4	7

Cr.

Income.	£	s.	d.
By Rent for Space	1273	12	6
„ Admissions	1465	5	0
„ Catalogues and Programmes	335	4	1
„ Fees for Further Trials	60	3	0
	£3134	4	7

STATEMENT of INCOME and EXPENDITURE

Dr.

Expenditure.	£	s.	d.	£	s.	d.
To Rent, Rates, Taxes, and Insurance	472	15	1			
,, Salaries and Wages	1089	19	3			
,, Coals, Lighting, and Care of Offices.........	160	2	1			
,, Repairs, Alteration, and Arrangement of Museum	147	14	11			
,, Library, Binding, &c.	12	13	11			
,, Postage and Carriage	173	6	4			
,, Printing and Stationery	203	12	11			
,, Advertising	21	3	2			
,, Incidental Expenses	81	9	7			
,, Law Charges	2	12	2			
,, Depreciation of Leaseholds	75	0	0			
				2380	9	5
To Journal and Publications, Cost of Printing, etc., less Sales and Advertisements	302	2	6			
,, Sessional Meetings	22	8	6			
,, Lectures, Sanitary Officers.....................	151	2	0			
,, Examination Expenses, exclusive of Establishment Charges........................	672	12	4			
,, Congress	442	6	9			
,, Illustrated List of Premiated Exhibits ...	45	19	11			
				1636	12	0
				4017	1	5
Balance, Excess of Income over Expenditure for the year 1897, carried over				859	10	9
				£4,876	12	2

Balance to be carried forward £10,415 10

for the Year ended 31st December, 1897.

Cr.

Income.	£	s.	d.	£	s.	d.
By Annual Subscriptions	1367	1	6			
" Entrance Fees	42	0	0			
" Fellowship Fee	5	5	0			
" Donation	1	1	0			
" Interest on Investments, etc.	206	7	10			
				1621	15	4
" Lectures, Sanitary Officers	157	8	6			
" Examinations	1957	12	1			
" Publications—Farr's and Simon's—Profit on Sales	1	8	9			
" Illustrated List of Premiated Exhibits ...	1	1	9			
" Congress	120	16	7			
" Balance Leeds Exhibition Account	1016	9	2			
				3254	16	10
				£4,876	12	2

	£	s.	d.
By Balance brought forward from last account (1896) ...	9555	19	7
" Balance for the year 1897 brought down	859	10	9
	£10,415	10	4

GENERAL BALANCE SHEET, 31st DECEMBER, 1897.

Liabilities.	£	s.	d.
To Fees and Subscriptions paid in advance for 1898	61	19	0
„ Life Composition Fund...	304	10	0
„ Library Catalogue Account	98	2	9
„ Sundry Creditors	765	15	4
„ Balance of Assets over Liabilities	10,415	10	4
	£11,645	17	5

Assets.	£	s.	d.	£	s.	d.
By Leases of Premises, Library and Contents of Museum, Furniture and Publications	1883	4	5			
„ Subscriptions in Arrear and Sundry Debtors	286	10	7			
„ Cash in hand and on Deposit..................	978	6	5			
				3098	1	5
„ Investment in 2¾% Consols, Amount at December, 1897	7452	15	0			
„ „ 3°/₀ India Stock	1095	1	0			
				8547	16	0
				£11,645	17	5

Examined with the Books and Accounts and found correct,

W. COLLINGRIDGE,
ALFRED LASS WOOD & Co., } *Auditors.*

Chartered Accountants.

7th March, 1898.

MEETINGS HELD JANUARY TO MARCH, 1898.

Lectures and Demonstrations to Sanitary Officers.

The Twenty-Fifth London Course of 17 Lectures and 19 Practical Demonstrations and Visits of Inspection to trade premises, Refuse Disposal Works, &c., commenced on February 27th. 65 Students entered their names for the Course.

Sessional Meetings.

A meeting was held on February 10th, when a discussion was opened by Prof. J. Lane Notter, M.A., M.D., on "The Purification of Water for Barracks, Prisons, and other Institutions." Louis C. Parkes, M.D., D.P.H., in the chair. About 60 Members, Associates, and Visitors attended.

On March 9th a discussion was opened by Christopher Childs, M.A., M.D., D.P.H., on "Water-borne Typhoid." Shirley F. Murphy, M.R.C.S., Medical Officer of Health Administrative County of London, in the chair. About 60 Members, Associates, and Visitors attended. Both the papers and discussions will appear in the Journal for July.

Examination.

At an Examination for Inspectors of Nuisances, held at Glasgow on February 4th and 5th, 12 Candidates presented themselves.

The following 7 Candidates were certified, as regards their Sanitary Knowledge, competent to discharge the duties of Inspectors of Nuisances:—

1898, Feb. 5. Fleming, Richard Philip, 84, Commercial Street, Dundee, N.B.
1898, Feb. 5. Gilfeather, John, 18, Church Street, Maxwelltown, Dumfries.
1898, Feb. 5. Irving, John, 79, Collins St., Townhead, Glasgow.
1898, Feb. 5. Macqueen, Andrew Stewart, 41, High Street, Linlithgow, N.B.
1898, Feb. 5. McClement, John, 3, Orchard Place, Renfrew.
1898, Feb. 5. Smith, Alexander, Convict Prison, Peterhead, N.B.
1898, Feb. 5. White, Miss Ada Nunn, 4, Warwick Terrace, Leeson Park, Dublin.

Examination Questions.

Inspector of Nuisances.—Glasgow, February 4th and 5th, 1898.

1.—What are the distinguishing characteristics of horse-flesh and beef, and how is the sale of horse-flesh regulated?

2.—In what manner do nuisances arise in connection with artificial manure works? What regulations are necessary for the proper conduct of the business?

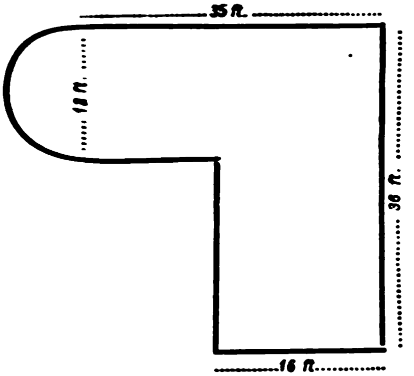
3.—Describe in detail the arrangements which should be made by a Sanitary Authority for the removal of infected goods to a Disinfecting Station and also for the return of the disinfected articles.

4.—What are the characteristics of water obtained from :—

(a) A Moor. (b) A Well sunk in the chalk.

Would the water from either source be likely to affect cisterns and service pipes?

5.—Give the cubic contents of a room of the shape and dimensions shown on the accompanying sketch plan, with a semi-circular bay at one end, and 9 ft. high. Show the details of the calculation.



6.—Contrast the advantages and disadvantages of heating a building—

(a) By hot-water pipes;

(b) By open fireplaces.

7.—Sketch and describe a combined system of back drainage (leading to a public sewer) for a terrace of houses, showing the house connections, position of traps, and ventilators.

8.—What is meant by house refuse and by trade refuse? What are the duties of a Sanitary Authority with reference to each?

The Candidates were examined vivâ voce *on the 5th.*

At an Examination in Practical Sanitary Science, held at Exeter, on March 4th and 5th, 1898, 3 Candidates presented themselves.

The following candidates were granted Certificates in Practical Sanitary Science:—

1898, Mar. 5. Page, Stanley Hatch, 23, High Street, Maidstone.

1898, Mar. 5. Quick, Edward Hare, Laureldale, Lympstone, Devon.

At an Examination for Inspectors of Nuisances, held at Exeter on March 4th and 5th, 11 Candidates presented themselves.

The following 5 Candidates were certified, as regards their Sanitary Knowledge, competent to discharge the duties of Inspectors of Nuisances.

1898, Mar. 5. Hoskins, George Albert, 61, Richmond Street, Plymouth.

1898, Mar. 5. Metcalfe, Richard Moore, 31, Claret Street, Accrington.

1898, Mar. 5. Rogers, Richard Alfred, Newton Abbot, S. Devon.

1898, Mar. 5. Coles, William George, 6, Devonia Terrace, Alphington, Exeter.

1898, Mar. 5. Rice, Evan Thomas, 77, Terrall Road, Mount Pleasant, Swansea.

Examination Questions.

Practical Sanitary Science.—Exeter, March 4th & 5th, 1898.

PAPER I.

1.—Explain the principle of the mercurial standard barometer, and the method by which its readings are corrected. What is meant by "capillarity" and "index error"?

2.—What laws govern the diffusion of gases? What bearing have they upon the question of ventilation?

3.—What are the chief powers in the Regulations under the Canal Boats Acts?

4.—Contrast the advantages of close stoves and open fires. Give a sketch with measurements of a good form of open fireplace.

PAPER II.

5.—A cubical cistern, the side of which is two feet, is half filled with water. Find the pressure on one of the vertical sides and on the bottom.

6.—Describe the properties of good Portland cement and the method of testing it. Specify the composition of good cement concrete.

7.—Explain the construction and give sketches of solid floors (*a*) of brick arches and concrete; (*b*) of iron and concrete; and (*c*) of iron, concrete, and wood combined.

8.—Of what materials may drains be constructed? and describe the laying of a drain through a water-logged soil.

The candidates were examined vivâ voce *on the 5th.*

Inspector of Nuisances.—Exeter, March 4th and 5th, 1898.

1.—What kinds of food are most liable to become unwholesome? What statutory provisions are there which deal with the sale of unsound food?

2.—For what purposes may it be necessary for the sanitary inspector to open up the ground on private premises? What powers does the Public Health Act give for this purpose?

3.—What precautions should be taken after a case of puerperal fever to prevent the spread of the disease?

4.—Describe what is meant by constant and what by intermittent water supply. State what are the dangers of pollution in each case, and how far they are aggravated by the effect of prolonged frost.

5.—Describe the various ways in which the wind may be used in the ventilation of houses.

6.—How much water could be collected from a slate roof covering a space of 220 square feet, in the three winter months, the rainfall during this period being eleven inches?

7.—What are the different kinds of manure receptacles in use in stables? Which do you consider the best for sanitary reasons?

8.—What are the essential points as regards the materials, construction, dimensions, position, and course of a soil pipe?

The Candidates were examined vivâ voce *on the 5th.*

Ordinary General Meeting.

The Ordinary General Meeting was held on March 23rd. Annual Report and Statement of Accounts for 1897 were submit The report, which is published on page 181, gives an account of various branches of work undertaken by the Institute.

The following Officers and Members of Council were electe(re-elected :—

As Vice-Presidents.

His Grace the Archbishop of Canterbury, P.C.
Right Hon. Earl Fortescue.
Sir F. Abel, Bart., K.C.B., D.Sc., D.C.L., F.R.S.
Sir Henry W. Acland, Bart., K.C.B., M.D., D.C.L., F.R.S.
Sir Douglas Galton, K.C.B., D.C.L., LL.D., F.R.S.
Sir W. Guyer Hunter, K.C.M.G., M.D., Q.H.S., LL.D., F.R.
Sir Francis Sharp Powell, Bart., M.P.
Sir Robert Rawlinson, K.C.B., M.Inst.C.E.
Sir Henry Thompson, F.R.C.S., M.B.
Prof. W. H. Corfield, M.A., M.D.Oxon., F.R.C.P.
A. Waterhouse, R.A., LL.D., F.R.I.B.A.
Thomas Salt, M.A., D.L., J.P.

As Members of Council.

Prof. Henry Adams, M.Inst.C.E., F.S.I.
H. Percy Boulnois, M.Inst.C.E.
Major Lamorock Flower.
Prof. A. Bostock Hill, M.D., D.P.H.
Lieut.-Col. A. S. Jones, (Assoc.M.Inst.C.E.
G. V. Poore, M.D., F.R.C.P
Prof. H. Robinson, M.Inst.(
Dawson Williams, M F.R.C.P.

As Treasurer.

Sir Douglas Galton, K.C.B., D.C.L., LL.D., F.R.S.

As Auditors.

W. Collingridge, M.A., M.D., D.P.H.
Alfred Lass, Wood & Co.

DINNER OF THE INSTITUTE.

March 23rd, 1898.

The Dinner of The Institute was held in the Holborn Restaurant on Wednesday, 23rd March, 1898. In the unexpected absence of the President of The Institute, H. R. H. The Duke of Cambridge, K.G., the Chair was taken by Sir Douglas Galton, K.C.B., D.C.L., LL.D., F.R.S., Chairman of the Council.

There were about 100 present.

In giving the toast of "The Queen," the Chairman, who was received with applause, said this toast was always received with the greatest enthusiasm, but he thought The Sanitary Institute should particularly emphasise the toast, because first of all the Queen was one of the original patrons of the Parkes Museum, which The Institute had assimilated to itself, and in the next place nothing had made greater progress during the Queen's reign than sanitary science.

The Chairman then gave "The Prince and Princess of Wales, and the other members of the Royal Family." He said the members of the Royal Family have been largely associated with The Sanitary Institute, and the cause of sanitation in general. The Prince of Wales was President of the Health Exhibition in 1883, and of the International Health Congress in 1891; The Duke of Edinburgh was President of the Medical and Sanitary Exhibition, organised by the Parkes Museum in 1891; The Duke of Albany was President of the Parkes Museum and presided at the opening of the present premises; and the Duchess of Albany is now patroness of The Sanitary Institute, and frequently attended their lectures. Then H.R.H. The Duke of Cambridge is the President of the Institute. H.R.H.'s intentions have been to preside at this Dinner, but his medical adviser has recommended H.R.H. to prolong his stay in a more genial climate. H.R.H. had written and regretting very much his absence from the gathering that evening.

Sir Joseph Fayrer, Bart., K.C.S.I., submitted the toast of "The Navy, Army, and Auxiliary Forces," and said that Englishmen loved their public services and were always delighted to take the opportunity of declaring that they did so. As Sir Douglas Galton had pointed out, The Sanitary Institute had special relations with those public services, or at all events with those exalted personages who represented them. He deeply regretted that H.R.H. the Duke of Cambridge, who they had expected to have been with them that evening, was not present. Had His Royal Highness been present he would have offered him their grateful thanks for all he had done for the institution, for his advocacy at the Mansion House and elsewhere of its claims, and for his general support of the cause since its commence-

ment. The Sanitary Institute was deeply indebted to the public services which had contributed to its development and advancement to its present condition, and it would be a dereliction of duty on his part, in proposing that toast, not to remind them of the services which had been rendered to The Institute by the distinguished officer who occupied the chair that evening. Having long known from practical experience that their chairman represented sanitary engineering in the highest degree, he had no hesitation in saying that Sir Douglas had done much for the Institute, and that as President of the Council, as its chief pillar, he was one who had conferred an inestimable benefit, not only upon the civil population, but also on the military population of this country, and was entitled to their most grateful acknowledgments. But such services were by no means confined to Sir Douglas Galton; he could refer to, among others, the lamented Professor Edmund Parkes, de Chaumont, Sir Thomas Crawford, to Professor Lane Notter, now in the full tide of his work, and Chairman of the Institute Board of Examiners; to Inspector-General Macdonald of the Royal Navy, to Sir William Guyer Hunter, Surgeon-General Cornish, and the late Inspector-General Lawson. These and many others had done much for the Institute; all admired it, and such considerations as this made the toast particularly appropriate at a gathering of the Institute, and with it he would couple the name of Major-General Carey.

Major-General C. PHIPPS CAREY, R.E., in responding, expressed regret that there was not a Member of the senior service present to do justice to the toast, but he thought that anyone who had been present at the Jubilee naval review must have been impressed not only with the brilliancy of the spectacle but also with the enormous power it revealed. It was in all respects worthy of the first sea power in the world. As to the Army, he was happy to say, that the nation, now thoroughly aroused to the necessity of providing for its land as well as its sea forces, had approved the recent additions voted by Parliament. As a proof of the spirit which animates that Army he had only to refer to the operations on the North-West frontier of India, where the most brilliant example had been given by both British and native troops that the best traditions of the service had been maintained. In regard to sanitary matters he thought the Army had kept pace with the times. Enormous improvements had been made, both as regards barrack and hospital accommodation, in all sanitary requirements essential to the health and well-being of the soldiers. Year by year the Volunteers had been increasing in efficiency, becoming more valuable both to the nation and to the Army as a final reserve, and when the day of trial came he had no doubt they would find themselves equal to any duty they might be called upon to discharge.

SIR ARTHUR BLOMFIELD, in proposing the toast of "The Houses of Parliament," said they would agree with him that it was impossible to say anything about either of the Houses of Parliament which has not been said many hundreds of times in many hundreds of assemblies

of that kind in much better language than he could pretend to command, but he would like to refer to the connection which the work of the Institute, a work so well known and so widely useful, had with the legislature. Its efforts in the direction of sanitary reform and improvement, in which they were all so much interested, and to which they devoted so much time, attention, and energy, were ultimately dependent upon the vote and will of the two Houses of Parliament for the measures, and sometimes for the means, to carry out those great works in which they felt so much interest. He was glad to find they had present that evening distinguished members of both Houses of Parliament, and it gave him great pleasure to couple with the toast the names of Earl Egerton of Tatton and Dr. Farquharson, M.P.

The Right Hon. EARL EGERTON OF TATTON, in replying for the House of Lords, remarked that he felt it a great honour to be allowed to respond to the toast so kindly proposed by his friend Sir Arthur Blomfield. He had had the opportunity of seeing the House of Lords from the point of view of one who had served for a quarter of a century in the Lower House of Commons, and he ventured to affirm from an acquaintance with both bodies that each in their way formed important and necessary parts of our constitution. The duties of the House of Lords were not confined to merely speaking and attending to work in the House itself, but he found from experience during the time he had had the honour of belonging to that body that its members were much in request for various enterprises and works, and that the confidence of their fellow-subjects was reposed in an extraordinary manner in members of the House of Lords. That in itself was a proof that the House of Lords had a strong hold upon the affections and respect of the country. With respect to The Sanitary Institute, although he had not the honour of being a member of it, he had served his apprenticeship under the late Lord Aberdare for several years on the Commission on Noxious Vapours. He had also in his capacity as a landowner various opportunities of carrying out those sanitary reforms which had been proposed and properly carried out within the last twenty-five years according to the Acts of Parliament administered by the local authorities. A very great amount of the heavy burden of that work had been thrown upon the House of Lords as representing the great landowners of the country. He did not say there might not be exceptions but speaking generally, he believed the members of the House of Lords had endeavoured loyally to carry out in those buildings over which they had control those sanitary requirements which had been prevalent among us for so long. Twenty-five years ago Mr. Disraeli said in Manchester that his programme was "Sanitas, sanitatum omnia sanitas," and they had acted upon it in the reforms which had been carried out under the auspices of and through the assistance of The Sanitary Institute and other sanitary associations throughout the country. He would not say, however, that all these questions had yet been satisfactorily solved. From his

connections with Manchester he had been brought into constant contact with pollutions of air and water. He had done his best to counteract the evil effects of the air receiving products that ought to be combusted and of water receiving products which ought never to have entered it. In sanitary matters in that direction he had done his best. He had recently received a communication from the Consul-General at New York, which seemed to throw further light on the treatment of sewage in large towns, which especially interested him as having a large interest in Manchester and in the Ship canal, in the report made to him by an American engineer, Mr. Waring, which advocated the further development of the treatment of sewage by bacteriolysis, carried out by forcing a very strong draught of air through the material through which the sewage is filtered, in such a way that immediately this strong blast of air is passed through the porous material, whatever it may be, cinders or coke, those friendly bacteria cleaned the whole thing out and rendered it available for further treatment of the sewage. If that could be established before the Commission which is shortly to be appointed he believed they would really get a scientific and economical way of dealing with sewage in large towns. He could assure them that in dealing with the sewage round Manchester they had a very serious and important question, in which he was deeply interested. He hoped also that in time the air would in some way be made purer. Lately they had been suffering from those fogs which certainly ought not to occur in large towns if they adopted a proper system of consuming the products of combustion. When they heard of lovely weather ten miles outside London one felt that science was yet much at fault in dealing with smoke and with the combustion of coal in our large towns. These matters were of great interest to members of The Sanitary Institute, and he trusted that in the following century they might see purer air and purer water throughout the fair fields and beautiful country of England, so that they might be able to say that science had triumphed over the difficulties which enormous populations congregated in large centres had brought upon us more rapidly thans cientific men had as as yet been able to deal with.

Dr. R. Farquharson, M.P., responded for the House of Commons and said that on like occasions he had sometimes been oppressed with the duty, for which he felt himself little competent, of replying for both Houses of Parliament. They could congratulate themselves that evening that they had among them a peer who, by his speech, had shown his keen appreciation of sanitation. He could say that their friend, Earl Egerton of Tatton, had co-operated with himself and other Members of Parliament to make the House of Commons well ventilated and well drained, and partly due to him, partly due to himself, and partly due to other Members of Parliament, they no longer breathed sewer gas, but got good air, so that the House of Commons was now being carried on under proper and sound sanitary

onditions. Not speaking as a party man—at that gathering they :new no party—he was bound to say that whatever they might think)f the present House of Commons, it was doing an uncommon amount of work, but he would say nothing about its quality; that might lead him into controversial obligations which would be undesirable. There was no doubt about the quantity, for scarcely a day passed in which there was not a second reading of a bill. Two nights ago they passed the reading of a very large bill which he hoped in the interests of all might be successful in settling that great question —Home Rule for Ireland. They were going to tackle a number of large questions, including dog muzzling, which would no doubt appeal to a very large and wide section of the public. These were some general questions in regard to the House of Commons, which was a fascinating place. There was no man who had once been in the House of Commons and lost his seat who did not feel a strong desire to go back, but everyone who went into the House of Commons at first experienced a sense of disappointment. There were one or two things in which the House of Commons was very much better than it used to be. He had now been a member of the House of Commons for eighteen years, and the present conditions were much better than in the good old days when they used to sit up to any hour of the night, and sometimes all night, now they had got a respectable rule by which they could all go home quietly to their homes and their wives—if they had them—at 12 o'clock. Then as he had already said they had a well ventilated chamber, for in fog time the air came in filtered through cotton wool, and in the summer time it was cooled by ice. From that point of view even the conditions were better; then they had better rules of procedure, the old method of alternate motions, adjourning here and adjourning there, being abolished, they got the work done much better and in a more practical way. When he had the honour of taking the chair at the Sanitary Institute not very long ago, he took the opportunity of saying that he had very little confidence in the House of Commons in all matters of hygiene. That was quite true. He thought both parties were bad, and although it was not a very patriotic utterance he thought that on the whole the party to which he was opposed was rather better than his own in this respect. But both parties were bad, and too much obstruction was put in their way if they attempted to do anything for public hygiene. Sir Joseph Fayrer struck a high note when he said that in connection with the expenditure on the public services for the protection of our empire both parties united in a common object. Well, he wished it were so in matters of hygiene. What they in the House of Commons wanted was a strong backing from outside. Those who had influence, and they were all influential men no doubt in some locality, should bring pressure to bear on members of Parliament—and he could tell them that members of Parliament were very amenable to pressure from their constituents—and then something might be done. The obstruction and opposition in the House of Commons was very discouraging to those who were trying to do a little work for the cause of hygiene and sanitation.

But in spite of all defects, the House of Commons was a great institution, theirs was a great country, backed up by these two great Houses, and he did not think they had occasion to be ashamed of either.

SIR E. GALSWORTHY, in submitting the toast of "The Sanitary Institute," paid a tribute to the eloquent, able, and amusing speech of Dr. Farquharson, and said he was unable to understand why the speech of the evening had been entrusted to him. He thought a singularly bad choice had been made, for he did not know much about The Sanitary Institute. He was not a member, though he was delighted to hear that he could be. He therefore could not tell them much about what they knew a great deal of. They had heard something that evening of the gentlemen who had done great work for The Sanitary Institute, and he would be very brief in referring to some of the features of its work. They had heard from the last speaker that the work done by the House of Commons is great in quantity but indifferent in quality. (DR. FARQUHARSON: No, I gave no opinion as to its quality). Well, he would accept that the work of the House of Commons was great in quantity, but he gave no opinion as to its quality (A laugh). It struck him that The Sanitary Institute differed very greatly from the House of Commons, which must be an altogether inferior body. (Laughter). Because he noticed that the work done by The Sanitary Institute had been great in quantity and admirable in quality. The Institute was founded in 1876, exclusively for the advancement of subjects which bear upon public health, and all branches of the work appeared to have steadily grown since the formation. All who desired to aid in the important work of improving the public health ought to support and co-operate with The Sanitary Institute. Now, he had the honour of belonging to a body called the Metropolitan Asylums Board, and when he cast his memory back to the origin of that Board thirty years ago, and when one thought of the arrangements or want of arrangements for sanitation, and the lack of sanitary knowledge in those days, the only wonder was that we have not had a great deal more infectious disease than we have had. If The Sanitary Institute had then been in existence, he did not doubt that much less disease would have arisen, and that vast sums of money would have been saved which have since been necessarily spent in modifying the sanitary arrangements of our public institutions. Now, the Metropolitan Asylums Board was not admitted by all people to be the most economical Board in London; but of course by all intelligent people it was. (Laughter). There was no one in that room, he took it, who was not an intelligent person, and therefore he need not labour that point. There were a good many fallacies about that Board, but they were invented for the benefit of the evening halfpenny papers. That Board should be, and he thought it was, greatly indebted to The Sanitary Institute for their work. They were anxious, and always would be anxious, to co-operate with the Institute, and if the work of the Institute should tend, as it

must, to the diminution of disease and suffering, and eventually to a diminution of expense by lessening the number of infected patients, perhaps the Board would then be still more economical than it is at present. However that might be, he thought they had to congratulate The Sanitary Institute upon the splendid work which it had done. He was delighted to find that its financial position was so good, and that nearly a thousand pounds had been carried to the reserve fund this year, and it had over £10,000 good assets now invested. That spoke well for the Institute. As an outsider he could appreciate the splendid work which it had done, and also appreciate the admirable work done by the chairman, Sir Douglas Galton. He understood that Sir Douglas had presided at a General Meeting at 5 o'clock, they now found him presiding over that gathering, and to-morrow morning at 9 o'clock he was going to Birmingham on the business of the Institute. That was energy which they could all admire, and he wished he were as young a man as their chairman evidently was. He should then look forward to getting through a tenth of his work. He trusted that the Institute would be as successful and progressive as it had been in the past, and begged to propose its continued prosperity.

SIR DOUGLAS GALTON, who was received with loud applause, in responding said he had great difficulty in replying to the toast which had been so ably, eloquently, and kindly proposed by Sir Edwin Galsworthy. It was a satisfactory thing to him to find that The Sanitary Institute was appreciated by the head of one of the most important sanitary departments in the metropolis. There were few branches of science which during the reign of Queen Victoria had made such progress as that of sanitation. They would all agree with him that the progress of sanitation had been largely due to the chemist and physiologist, and more recently to the psychologist. Our experience, our knowledge of water supply, of the power of maintaining health and adequate purity in our water supplies, rest largely upon the chemist and the physiologist; that department which Sir Edwin Galsworthy presides over has to depend for the safety of the patients whom it receives into its hospitals upon the physiologist, and for the mental cultivation of the various persons whom it receives into the asylums upon the labours of the psychologist. Sanitarians had much to thank the progress of other sciences besides their own in these respects. He was afraid that they must all feel that sanitation had not penetrated into the nation in the way in which they would have desired it should do. He was chairman of a sanitary committee of a county council in the country, and he found that numerous pollutions were going into the streams of that county from the houses, from the villages, from the small towns, seriously injuring the condition of their streams and rivers, and yet everyone of those sources of pollution might have been arrested at their origin if there was sufficient education, or rather, desire and energy in the people themselves to stop them. There were other matters in which he thought our sanitary services were singularly

wanting, and in which the appreciation of the public for sanitation was equally indifferent. Large quantities of butter were being brought from the continent mixed with preservatives which are dangerous to health. Steamboats were being constructed for the purpose of bringing milk from abroad to this country, which would be similarly adulterated, and no efforts were being made at the ports of entry to prevent the distribution of these adulterated articles. Through the care and efforts of Sanitarians, among whom our own member, Dr. C[illegible], was a prominent instance, the quarantine had been abolished; that was a very desirable measure, but it was accompanied by the regulation that all persons arriving by a suspected vessel should be carefully examined and watched during a specified time afterwards to see that no infection broke out amongst them. Similarly if we admitted butter and milk free of duty care should be taken to see that these articles were pure and did not contain matter injurious to health. He was afraid that with all their self-congratulations as to the progress of sanitation they must admit that the nation had only as yet touched the fringe of the question. So long as the higher sanitary administration of the nation remained an appendage of the Poor Law administration there could be no proper care for the health services of the country. The sanitary care of the metropolis was scattered under many authorities, each separate from the other. In the counties and in the small towns, even in some important towns, sanitation was not appreciated. In many places medical officers, public analysts, and sanitary inspectors were badly paid, and nowhere have they that certain tenure of office which is necessary to ensure the fullest devotion to the services in which they are engaged The nation still remained largely supine and somewhat ignorant of its true duties in this respect. The Victorian era had undoubtedly developed sanitation, and the improvement which it had introduced originated with pioneers like Budd, Farr, Southwood, Smith, Parkes, Rawlinson, Chadwick, Richardson. But with justice he might claim that The Sanitary Institute has had an important share in the progress made during the latter years of this century. The Sanitary Institute was founded as a consequence of the recognition by Parliament in 1872 of the importance of codifying and improving the scattered laws which up to that time had regulated the sanitation of the country. The Sanitary Institute was founded for the purpose of educating the public in the requirements of this new science. It had largely fulfilled the mission which its originators set before them. The Sanitary Institute assimilated to themselves the Parkes Museum, they had developed it, and now maintain it, freely open to the public, not as a place for the display of the wares of manufacturers, but as a well considered exhibition of what is newest and best, and which shows the latest applications of the science of practical hygiene. As an evidence of the appreciation in which it is held he might mention that it was visited in 1897 by 17,500 persons, and that 53 different institutions sent classes there to be instructed by their own professors. The Sanitary Institute held Congresses in various important centres, to

which the leading sanitary authorities throughout the country willingly came, because they were able to discuss and exchange views upon important questions which interest them. Exhibitions in connection with those congresses had been held during the last twenty years, and by the adoption of a careful and systematic method of judging exhibits they had preserved not only a continuity but had established a uniformity in the principles upon which the awards are based. Owing to The Sanitary Institute a feeling had been created and it was gradually spreading in the public mind that it is of the first importance that the officers who administer the sanitary laws should be thoroughly qualified for the offices they hold. The Institute originated examinations in sanitary knowledge for sanitary inspectors and borough surveyors, but the Surveyors' Institute, the British Architects, the Civil Engineers, had perceived how important this class of knowledge is, and those bodies now required that sanitation should form a branch of the examinations which these Societies now require that those who join them should possess. But The Sanitary Institute at present remained practically the sole examining body for sanitary inspectors, and it had devoted much time and labour to improving the education of those persons; 2,400 certificates had now been issued for competency and qualification to hold the offices of Sanitary Inspector. Through much difficulty and through many troubles they had attained to their present position; the Institute had now more than 2,000 members, it had an invested capital of nearly £11,000, and an income in excess of expenditure, and they devoted that income entirely to extending their influence and usefulness. The past principles of the Institute had been to devote their funds entirely to the maintenance of their museum and library, and the organisation of lectures not only for the public, but chiefly for the education of Sanitary Inspectors, for whom they had provided special lectures in various parts of the country. Further, the lease upon which they held their premises had not many years to run, and they were now considering how to extend its usefulness either by an addition to their present buildings, or by the acquisition of a new site. They had progressed steadily in the past, because they had had before them a single-minded desire to convey to the nation a due appreciation of the value of sanitation, and to assist its progress; and so long as they continue to administer The Sanitary Institute on the same lines, he did not think they need have any fear as to its future progress in usefulness and in success.

FORTHCOMING MEETINGS.

Calendar, April to June, 1898.

As far as at present arranged.

*Council Meetings are held Monthly on the Second Wednesday in each Month at 5 p.m., except August and September.

Special Purposes Committee .	. Third Monday at 5 p.m.
*Finance Committee . .	. Second Wednesday at 4.30 p.m.
Exhibition Committee . .	. First Tuesday at 5 p.m.
†Congress and Editing Committee.	Second Monday at 5.15 p.m.
Museum and Library Committee	. Fourth Monday at 5 p.m.
Parliamentary Committee .	. As occasion requires.

* Note.—*The April Meeting will be held a week earlier.*

† *The April Meeting will be held on the first Monday.*

APRIL.

1 F., 2 S. Examinations in Practical Sanitary Science and for Inspectors of Nuisances, Birmingham.

2 S. Inspection and Demonstration at Morden Hall Farm, Morden, Surrey, at 3 p.m.

4 M. Lecture to Sanitary Officers at 8 p.m. House Drainage, by W. C. Tyndale, M.INST.C.E.

6 W. Inspection and Demonstration in the Parish of St. George's, Hanover Square, at 2 p.m., conducted by Albert Taylor, Chief Sanitary Inspector.

6 W. Sessional Meeting at 8 p.m. Discussion on The Desirability of making Water Shed Areas and Sanitary Districts coterminous, by R. E. Middleton, M.INST.C.E.

6 W. **Meeting of Council.**

8-11. **Easter.**

18 M. Lecture to Sanitary Officers at 8 p.m. Sanitary Appliances, by G. Reid, M.D., D.P.H.

20 W. Inspection and Demonstration at Disinfecting Works and Steam Laundry, at 3.30 p.m., conducted by W. G. Lacy.

21 Th. Lecture to Sanitary Officers at 8 p.m. Details of Plumbers' Work, by J. Wright Clarke.

23 S. Inspection and Demonstration at Beddington Sewage Farm, at about 3 p.m., conducted by Thomas Walker, M.INST.C.E.

25 M. Lecture to Sanitary Officers at 8 p.m. Scavenging Disposal of House Refuse, by Charles Jones, M.INST.C.E.

25 M. Inspection and Demonstration at St. Pancras Refuse Destructor Station, at 3 p.m., conducted by W. N. Blair, M.INST.C.E.

28 Th. Lecture to Sanitary Officers at 8 p.m. Sewerage and Sewage Disposal, Prof. Henry Robinson, M.INST.C.E.

30 S. Inspection and Demonstration at Barking Sewage Outfall Works, at about 3 p.m., conducted by John Edward Worth, M.INST.C.E.

MAY.

6 F., 7 S. Examination in Practical Sanitary Science and for Inspectors of Nuisances, London.

JUNE.

10 F., 11 S. Examination in Practical Sanitary Science and for Inspectors of Nuisances, Leeds.

24 F., 25 S. Examinations in Practical Sanitary Science and for Inspectors of Nuisances, Belfast.

JULY.

8 F., 9 S. Examinations in Practical Sanitary Science and for Inspectors of Nuisances, Cardiff.

29 F., 30 S. Examinations in Practical Sanitary Science and for Inspectors of Nuisances, Liverpool.

The Congress will be held at BIRMINGHAM, commencing September 27th.

FELLOWS, MEMBERS & ASSOCIATES ELECTED,

From January to March, 1898, inclusive.

(A complete list can be had on application.)

FELLOW.

673 1898. Mar. Rideal, S., D.SC.LOND., F.I.C., 28, *Victoria St., S.W.*

MEMBERS.

* Passed Examination in Practical Sanitary Science.
‡ Passed Examination as Inspector of Nuisances.

Reg. No.	Date of Election.	
1161	1898. Feb.	Adamson, M., ASSOC.M.INST.C.E., 16, *Stafford Road, Plaistow, E.*
1162	1898. Feb.	Back, Herbert Hatfield, M.B., M.R.C.S., M.O.H., *Reepham, Norfolk.*
1176	1898. Mar.	Barham, G. Titus, *Sudbury Park, Wembley, Middlesex.*
1163	1898. Feb.	*‡Bennett, Samuel B., 5, *Portland Grove, Fallowfield, Manchester.*
1164	1898. Feb.	Buck, Joseph, M.O.H., *Hunslet R.D.C., Rothwell, near Leeds.*
1177	1898. Mar.	Butler, W., M.B., C.M., D.P.H., 26, *Craven Park Road, Harlesden, N.W.*
1154	1898. Jan.	Chasemore, Archibald Ellis, *Assistant Surveyor, Wandsworth District Board of Works, "Eberbach," Oxford Road, Putney, S.W.*
1165	1898. Feb.	*‡Collins, William Alexander, 55, *Forest Drive, W. Leytonstone.*
1166	1898. Feb.	Cresswell, William Thomas, P.A.S.I., *Vestry Hall, Borough Road, Southwark.*
1178	1898. Mar.	Erskine, Robert, M.D., MCH., M.A., D.P.H., 62, *Pembridge Villas, Bayswater, W.*
1167	1898. Feb.	Farrant, Mark, Jnr., L.R.C.P., M.R.C.S., M.O.H., 137, *St. Thomas, Devon.*
1179	1898. Mar.	Jackman, Charles Howard, L.R.C.P., &c., *Deputy Medical Officer for South Hornsey and Stoke Newington District*, 11, *Stoke Newington Road, N.*
1168	1898. Feb.	Lindsay, Robert, *India Buildings, Victoria Street, Edinburgh.*
1169	1898. Feb.	*Masters, William James, 49, *Oldfield Road, Sparkbrook, Birmingham.*

Reg. No. | Date of Election.

[illegible] 1898. Feb. ‡MILLARD, Charles K., M.D., B.SC.PUB.HEALTH, *City Hospital, Birmingham.*

[illegible] 1898. Jan. MOSSOR, John, A.R.I.B.A., *Billiter Square Buildings, E.C.*

[illegible] 1898. Mar. PICKERING, S. A., ASSOC.M.INST.C.E., *Boro' Surveyor, Boro' Surveyor's Office, Oldham.*

[illegible] 1898. Feb. ROBINSON, Thomas, M.O.H., D.P.H.CAMB., M.R.C.S. ENG., L.R.C.P.LOND., 6, *Scalpcliffe Road, Burton-on-Trent.*

[illegible] 1898. Feb. *‡SALT, Arthur, 5, *Palmerston Road, Sparkbrook, Birmingham.*

[illegible] 1898. Mar. *SMITH, Frederick J. Osborne, 7, *Old Queen Street, Westminster, S.W.*

[illegible] 1898. Feb. SNELL, Ernest Hugh, M.D., D.P.H.CAMB., B.SC., M.O.H., 9, *Hay Lane, Coventry.*

[illegible] 1898. Jan. SPRKAY, Frank A., M.R.C.S., L.S.A., D.P.H., R.C.P.&S., *Whetstone, N.*

[illegible] 1898. Mar. STANLEY, Arthur, M.D., B.SC., D.P.H., *M.O.H. for Shanghai, North-Western Hospital, Haverstock Hill, N.W.*

[illegible] 1898. Jan. STOTT, Hugh, L.R.C.P., M.R.C.S., L.S.A., M.O.H., D.P.H. LOND., *Patterdale, Newick, near Lewes, Sussex.*

[illegible] 1898. Feb. VINT, G. E., ASSOC.M.INST.C.E., *Town Hall, Sheffield.*

[illegible] 1898. Jan. WADIA, Hon. N. N., ASSOC.M.INST.C.E., M.I.M.E., F.S.A., C.I.E., *Bella-vist, Cumbulla Hill, Bombay.*

[illegible] 1898. Jan. WELLS, F. Beauchamp, 1, *Victoria Square, Cotham, Bristol.*

[illegible] 1898. Jan. WILLOUGHBY, Edward Francis, M.D., D.P.H., *Bratton Lodge, Green Lanes, N.*

[illegible] 1898. Feb. WINSHIP, George, ASSOC.M.INST.C.E., *Borough Surveyor, Borough Buildings, Abingdon.*

ASSOCIATES.

‡ Passed Examination as Inspector of Nuisances.

[illegible] 1898. Feb. ‡ALEXANDER, Arthur Edward, *High Street, Fordingbridge.*

1640 1898. Feb. ‡ARIS, Algernon Sidney, 31, *Smith Street, Bloomsbury, Birmingham.*

1641 1898. Feb. ‡BONNET, William Henry, 28, *Manor Lane, Lee, S.E.*

1642 1898. Feb. ‡CALNAN, Arthur, 242, *Commercial Road, E.*

1643 1898. Feb. ‡CLARKE, William H., *Spring Dale, Eagle Street, Coventry.*

1644 1898. Feb. ‡CHILD, H. Robert, 91, *Abbey Road, St. John's Wood.*

1715 1898. Mar. ‡CLARKE, George Frederick, 109, *Antill Rd., Bow, E.*

1695 1898. Feb. ‡COLEMAN, William, *Church Road, Risborough, Sandgate.*

1716 1898. Mar. ‡COOK, James William, 2, *Park Place Villas, Maida Hill, W.*

Reg. No. | Date of Election.

1686 1898. Feb. ‡CORBRIDGE, William, 14, *Arnold Street, Bolton.*

1673 1898. Jan. ‡EMARY, F. S., 260, *Harold Road, Hastings.*

1687 1898. Feb. ‡FERNLEY, James Thomas, *Lane End, Marple Bridge, Derby.*

1688 1898. Feb. ‡FREEMAN, Louis V., 85, *Rutland Street, E.*

1717 1898. Mar. ‡GARRET, Albert Edward, 16, *South View, Great Harwood, Blackburn, Lancaster.*

1689 1898. Feb. ‡GIBBS, William H., 126, *Medway Road, New Brompton.*

1674 1898. Jan. ‡GREGORY, Thomas, *Newburn-on-Tyne.*

1690 1898. Feb. ‡HANDLEY, R. Illingworth, 19, *Blessington Road, Anfield, Liverpool.*

1691 1898. Feb. ‡HEDGCOCK, James Ernest, *Finchdene, Horndean.*

1692 1898. Feb. ‡HILL, Thomas, 4, *Coningsby Cottages, Coningsby Road, South Ealing.*

1693 1898. Feb. ‡HUMPHREY, W. T., 11, *High Street, Fulham, S.W.*

1694 1898. Feb. ‡HURST, George Frederick, *The Woodruffs, Coalville, near Leicester.*

1718 1898. Mar. ‡IRVING, Hiram, 11, *Jasmine Street, Everton, Liverpool.*

1675 1898. Jan. ‡JAMESON, William, *Market Place, Northallerton.*

1695 1898. Feb. ‡JENKINS, Arthur, 170, *Sunny Hill Road, Streatham, S.W.*

1696 1898. Feb. ‡JUDD, Henry, 53, *Robert Street, Ynysybwl.*

1719 1898. Mar. ‡LANIGAN, John, 42, *Brownbill Street, Salford.*

1720 1898. Mar. ‡LONGBOTTOM, Henry, *Silsden, Yorkshire.*

1721 1898. Mar. ‡MANDBY, John Charles, 192, *Camberwell New Road, S.E.*

1697 1898. Feb. ‡MARKHAM, Walter E., 79, *Essex Road, Islington.*

1698 1898. Feb. ‡MARSDEN, R. E., 121, *Lee Road, Blackheath, S.E.*

1699 1898. Feb. ‡MOORE, Ernest W., 9, *Bath Parade, Cheltenham.*

1676 1898. Jan. ‡NEWTON, Edward Arthur, 13, *Meyrick Road, Clapham Junction, S.W.*

1722 1898. Mar. ‡NORRIS, Henry John, 3, *Brunswick Villas, Herne Bay, Kent.*

1700 1898. Feb. ‡ORMROD, John, 62, *Chorley New Road, Bolton.*

1701 1898. Feb. ‡ROCLIFFE, Miss Gertrude E., *Ashford House, Newcastle-upon-Tyne.*

1723 1898. Mar. ‡RUTHERFORD, David, 16, *Walker Terrace, Edinburgh.*

1702 1898. Feb. ‡SELF, F. Blane, 17, *Southboro' Road, South Hackney, E.*

1677 1898. Jan. ‡SHILLINGTON, Miss Eleonora Henrietta, 30, *Fitzroy Square, W.*

1703 1898. Feb. ‡SIMONS, Miss G., *Argyle Villa, Argyle Road, Teddington.*

1704 1898. Feb. ‡SMITH, Walter, *Pioneer Sergeant, Chelsea Barracks.*

1705 1898. Feb. ‡STREATHER, Edward, 2, *Evelyn Street, Deptford, S.E.*

Reg. No.	Date of Election.	
[illegible]	1898. Feb.	‡SWAN, E. Arthur, 74, *Culverden Park Road, Tunbridge Wells.*
[illegible]	1898. Feb.	‡TAIT, Arthur E., 13, *Deleval Terrace, Waterloo, Blyth.*
[illegible]	1898. Feb.	‡TAYLOR, William Thomas, 182, *Burrage Road, Plumstead, S.E.*
[illegible]	1898. Feb.	‡TYLDESLEY, Martin, 129, *Elliott Street, Tyldesley.*
[illegible]	1898. Feb.	‡WAKEFORD, Mrs. Eliza, 17, *Arnold Place, Wibsey Hill, Bradford.*
[illegible]	1898. Feb.	‡WALL, John A., 50, *Uverdale Road, Chelsea, S.W.*
[illegible]	1898. Feb.	‡WALTER, Edwin, 24, *Uplands Road, Hornsey, N.*
[illegible]	1898. Feb.	‡WESTON, Enoch, 32, *Hambro' Road. Streatham.*
[illegible]	1898. Jan.	‡WHITE, William Lamb, *Erdington, Warwick.*
[illegible]	1898. Mar.	‡WILCOCK, Edwin, 20, *Lime Grove, Didsbury, Manchester, Lancashire.*
[illegible]	1898. Feb.	‡WILLCOCK, James, *Worsley, U.D.C.*
[illegible]	1898. Mar.	‡WILLIAMS, James, 195, *Henry Street, Llwynypia, R.S.O., Glam.*
[illegible]	1898. Mar.	‡WRIGHT, S. Dennis, 83, *Lower Villiers Street, Wolverhampton.*

OBITUARY.

DR. PROSPER DE PIETRA SANTA.

(HONORARY FELLOW.)

DR. PROSPER DE PIETRA SANTA died on Tuesday, Jan. 25th, of broncho-pneumonia. He was born on June 26th, 1820, at Ajaccio, in Corsica, and he was educated at Marseilles. Having obtained his degree of "Bachelier des Sciences," he went to Italy to study medicine in Pisa. At the age of thirty he returned to France, studied medicine at Montpellier, obtained the degree of Doctor in Medicine. The thesis he wrote on that occasion was his well-known work on Climatology. On the accession of Napoleon III., to whom he was related, Napoleon conferred upon him the honorary office of consulting physician.

Shortly afterwards he was appointed Medical Superintendent of the prisons des Madelonnettes, de Mazas et de la Santé. In this office he studied the effects of solitary confinement on the mental and bodily health of the prisoners, and wrote a vigorous protest against the system, entitled "Mazas et l'Emprisonnement cellulaire." The Imperial Government subsequently employed him to investigate the climates of the

South of France, of Algeria and Corsica. The results of his studies were published in four volumes. In 1873 de Pietra Santa took up the subject of cremation, and continued throughout his life to advocate this method of disposal of the dead. In 1876 he established the *Journal d'Hygiène*, and in 1877 took a prominent part in founding the Société Française d'Hygiène, the first Society of the kind in France. De Pietra Santa was an Honorary Fellow of The Sanitary Institute, and was known personally to most of those in this country who are interested in Hygiene. The amiability and force of his character endeared him to many friends, and his loss is widely and deeply regretted.

A. W. B.

ERNEST HART, M.R.C.S., D.C.L.

(FELLOW.)

Mr. Ernest Hart died at Brighton on January 7th, 1898, after a long illness, borne with much fortitude.

Ernest Hart was born in London of Jewish parents in June, 1835. He received his early education at the City of London School, where he had an extremely brilliant career. The University of Cambridge, to which he might have taken up a scholarship but for the accident of nationality being closed to him, he entered Mr. Lane's Grosvenor Place School of Medicine.

While still a Student, he showed the bent of his genius by taking an active part in the formation of a Society of Medical Students, which had for its object to obtain better conditions for the Officers of the Naval Medical Service. Something was then accomplished, but it was only in later life that he was able to see the fruition of labour undertaken at this early age. He served as House Surgeon in St. Mary's Hospital in 1856, and after a short term of office as Surgical Registrar at St. George's Hospital, he resumed his connection with St. Mary's Hospital, where he became Ophthalmic Surgeon in 1861. Two years later he became Dean of the Medical School. Meanwhile he was not only engaged in Surgical practice, his speciality being Ophthalmology, but was also leading contributor to the *Lancet*. While thus engaged he became a member, along with Dr. Anstie and Dr. Kerr,,of a Commission appointed by that Journal to investigate the condition of Poor Law Infirmaries in London, with special reference to the nursing of sick paupers. The facts which this Commission, with the assistance of Dr. Joseph Rogers, brought to light, led to the appointment by the Home

Secretary of a Special Medical Commission under the Presidency of Sir Thomas Watson. On the report of this Commission "Garthorne Hardy's Act" was founded. It led to a great improvement in the treatment of paupers in London, and through the formation of the Metropolitan Asylums Board has had a far-reaching influence on the public health of London. In 1866 Mr. Hart was appointed to succeed Dr. Markham as Editor of the *British Medical Journal.* He devoted himself with great energy and skill to the interests of that Journal, and in 1872 his influence on public health affairs was largely increased by his election as Chairman of the Parliamentary Bills Committee of the British Medical Association. He utilised this position for the systematic study of all legislative proposals affecting sanitary matters, and brought to bear upon their discussion an enlightened medical opinion. He was an ardent champion of the reform of local government which culminated in the Act of 1888, and worked hard for the appointment of County Medical Officers of Health, and for giving security of tenure to Medical Officers of Health in general. He contributed to bring about the recognition of this principle in the Public Health (London) Act of 1891, and in the Public Health (Scotland) Act of 1897. Mr. Hart became Chairman of the National Health Society in 1877, and did much to extend its work of popularising a knowledge of hygiene among the more ignorant classes, upper and lower. He was for some time a member of the Council of The Sanitary Institute, and it must gratefully be remembered that when the Parkes Museum was in financial straits, owing to the expenses incurred in connection with its removal to the building in which it is now placed, he came to its assistance with his influence and purse. Apart from his general work in connection with public health legislation, his chief claims to recognition as a sanitary worker are:—his consistent advocacy of vaccination, and more especially of vaccination from the calf, a method about officially to be adopted in this country; his efforts to obtain the abatement of the smoke nuisance; his work in connection with the registration of plumbers; and his great collection of material bearing on the dissemination of disease, especially typhoid fever and cholera, by means of water and milk. His observations and conclusions on these matters were brought into a final form in two reports, entitled "Water-borne Typhoid, a Historic Summary of Local Outbreaks in Great Britain and Ireland, 1858–93 (with a Tabular Analysis of 205 Epidemics)," and "A Report on the Influence of Milk in Spreading Zymotic Disease, with a Tabular Analysis of Forty-eight Outbreaks."

One of the most remarkable episodes of his career was his

sanitary crusade in India in 1894. He attacked the somewhat antiquated methods for dealing with cholera in use in India from the point of view of one thoroughly impressed with the universal application of the water-borne theory. He roused a good deal of opposition, which was to be traced in large measure to the trenchant form in which his criticisms were cast, but he roused also a very widespread interest, and his speeches and addresses have undoubtedly made a distinct impression upon the manner in which matters connected with the prevention of epidemics are regarded by the Government of India.

D. W.

SIR RICHARD QUAIN, Bart., M.D., F.R.S.

(Member.)

Sir Richard Quain died on March 13th, 1898, in his eighty-second year, after a long and painful illness. He was born at Mallow, in the County Cork, and to the end of his days retained the rich southern brogue, as well as the ready wit of the typical Irishman. After serving an apprenticeship in Limerick he became a student at University College, London, and was subsequently for five years House Physician to University College Hospital. Having subsequently commenced practice as a physician in London he was appointed Assistant Physician to the Hospital for Consumption, Brompton, then newly established. He was afterwards Physician to this Hospital, and finally Consulting Physician. In 1860 he was nominated by the Crown a member of the Senate of the University of London, and became Chairman of the Brown Animal Sanatory Committee, by which the Brown Institution is conducted. In consequence, doubtless, of his connexion with this Institute he was appointed a member of the Royal Commission on the Cattle Plague in 1865. He had many relations with the more influential writers for the periodical press, and was able with their co-operation to contribute to the formation of a public opinion which rendered the acceptance of the drastic measures recommended by that Commission possible. He was appointed a member of the General Medical Council in 1861, and served first as Secretary and afterwards as Chairman of the Committee which is charged with the periodical revisions of the *British Pharmacopœia.* Only a few weeks before his death he had formally handed over for publication the proof sheets of the new (1898) edition of the Pharmacopœia. In 1891 he had been elected President of the General Medical Council, an

office which he retained to the time of his death. Though the friend of nearly all the great writers of this and the last generation, he was not himself a voluminous author. He wrote on fatty degeneration of the heart, and quite recently on the causation of the first sound of the heart, but his chief literary achievement was the editing of the great *Medical Dictionary* which bears his name. He was an original member of the Corporation of the Parkes Museum. He was created a Baronet in 1891, but leaves no son to inherit this honour.

D. W.

EXHIBITS ADDED TO THE MUSEUM.

JANUARY TO MARCH, 1898.

Diseases in Relation to Food Supply. Two framed collections of coloured plates. *Selected by H. R. Kenwood, M.B.*

Tubercle in Muscular Tissue. Specimen. *W. A. Bond, M.D.*

Lantern Slides. Photographs of unsanitary dwellings. *S. G. Lovell.*

Gas Engines. Two framed photographs. *Crossley Bros.*

"Opalite." Fixed on wall at the entrance of the Museum. *W. Griffiths.*

Lavatory Basin, with side outlet, accessible waste and overflow, and marble top; fitted in Lavatory section. *J. Tylor & Sons.*

Drain Stoppers. Specimen of 6 in. and 4 in. Stoppers, with air pump. *A. W. Reid & Co.*

Old Lead D Traps, corroded and decayed; removed from a warehouse in the City, where it discharged through a hole in an 18 in. wall into a brick drain without any connecting pipe or branch. *G. E. Downes.*

Furred Pipes. Iron: from the neighbourhood of Potters Bar. *G. E. Downes.*

Bad Plumbing. Specimen of soil pipe with branch, two D traps, various wastes and connections badly designed and executed. *G. E. Downes.*

Tile Drain Pipe. Removed from premises at Stoke Newington. *H. R. Kenwood, M.B.*

Bituminous Pipe. Over 70 years old; removed from premises at Stoke Newington. *H. R. Kenwood, M.B.*

Wooden Water Pipe. With iron ring in socket, taken up in Hans Crescent, Chelsea. *Louis C. Parkes, M.D.*

Stanford Jointed Pipes. Old pipes found defective and leaking. *Louis C. Parkes, M.D.*

Canister for Food Samples. Arranged for taking samples under the Food and Drugs Act. *Burgess & Mathews.*

CONTRIBUTIONS AND ADDITIONS TO LIBRARY

JANUARY, TO MARCH, 1898.

*** *For publications of Societies and Institutions, &c., see under "Academies."*

Bangalore. Reports on the Conservancy and Main Sewer of the Civil and Military Station. 20 pp., 8vo. 1893-4.

British Columbia. Seventh Report of the British Columbia Fruit Growers and Horticultural Society. 110 pp., 4to. Victoria, B.C., 1897. *The Library Commissioners.*

Brown, *Wm.* The Sanitary Problem from the sewer-gas point of view. 18 pp., 8vo. Reprint from the *Public Health Engineer*, Dec. 24th, 1897. *The Author.*

Buchan, D. W. Practical Notes on House Sanitation. 39 pp., 8vo. Glasgow, 1898. *The Author.*

Canada. *Laboratory of the Inland Revenue Department, Ottawa.* Bulletins 49, 52, and 53: Fertilizers, Malt Liquors, Milk. 8vo. Ottawa, 1897. *T. Macfarlane, Chief Analyst.*

Childs, *Christopher, M.D., D.P.H.* The History of Typhoid Fever in Munich. 18 pp., 8vo. Reprinted from the *Lancet*, February 5th, 1898. *The Author.*

Cooper, *F. A., B.A.Lond.* The origin of Zymotic Diseases. 21 pp., 8vo. Birmingham, 1897. *The Author.*

Dibdin, *W. J., F.I.C., F.C.S.* Purification of Sewage and Water. 248 pp., 8vo. London, 1897. Sanitary Publishing Co. Price £1 1s. *Purchased.*

Exeter. Reports of the Local Government Enquiry on the Septic Tank System of Sewage Treatment. 48 and 41 pp. Reprints from the *Devon Evening Express* and *Daily Western Times*, Nov. 23—26, 1897. *The Town Clerk.*

Frankland, *Percy F., F.R.S.* Report on the character of the Belfast Water Supply. 14 pp., 4to. Birmingham, 1897. *James Munce, Assoc.M.Inst.C.E.*

Geological Survey. Soils and Subsoils from a sanitary point of view; with especial reference to London and its neighbourhood, by Horace B. Woodward, F.R.S. 58 pp., 8vo. London, 1897. Wyman & Sons, price 2s. 6d. *Director-General.*

——— Guide to the Geology of London and the neighbourhood, by W. Whitaker, B.A., F.R.S. 90 pp., 8vo. London, 1889. *Purchased.*

Iowa State Board of Health. Ninth Biennial Report, for the fiscal period ending June 30th, 1897. 375 pp., 8vo. Des Moines, 1897. *The Board.*

Jackson, *D. D., and* **Ellms,** *J. W.* On Odours and Tastes of Surface Waters, with special reference to Anabœna, a microscopical organism found in certain water supplies of Massachusetts. 10 pp., 8vo. Excerpt *Technology Quarterly*, Vol. X., No. 4, December, 1897. *D. D. Jackson.*

Kinsey-Morgan, *A., M.D.* The Climate of Bournemouth in relation to Disease, especially Phthisis. 51 pp., 8vo. Bristol and London, 1897. *Miss A. M. Johns.*

Leipzig. Achtundzwanzigster Jahresbericht des Landes-Medicinal-Collegiums über das Medicinalwesen im Königreiche Sachsen auf das Jahr 1896. 379 pp., 8vo. Leipzig, 1897. *Dr. Rudolf Günther.*

Leyton. Particulars of Sewage Sludge and Refuse Destructor Works. 7 pp., 8vo. Leyton, 1898.

Local Government Board. Dr. W. W. E. Fletcher's Report on an Inspection of the Witney Urban District, more especially in relation to the disposal and removal of House Refuse and Nightsoil. 4 pp., fcap. London, 1897.

——— Twenty-fourth Annual Report, 1894-95. Supplement in continuation of the Report of the Medical Officer for 1894-95—Inland Sanitary Survey, 1893-95. 284 pp., 8vo. London, 1896.

——— Dr. F. St. George Mivart's Report on an Outbreak of Enteric Fever at King's Lynn. 12 pp., fcp. London, 1898.

——— Dr. G. S. Buchanan's Report upon an Outbreak of Enteric Fever at Wadebridge, in the Rural District of St. Columb Major; upon the Sanitary condition of the place; and upon Administration by the St. Columb Major Rural District Council. 12 pp., fcp. London, 1897. *Sir Richard T. Thorne, K.C.B., F.R.S.*

MEDICAL OFFICERS OF HEALTH AND OTHER SANITARY REPORTS.

Kidderminster, 1897 .. *Dr. D. Corbet.*
Midlothian C.C. (San. Insp.).. *Robert Lindsay.*
Reigate (San. Insp.), 1897 .. *J. P. Humphery.*
Taunton, 1897 .. .. *H. J. Alford, M.D.*
West Riding C. C., 1896 .. *J. R. Kaye, M.B.*

Nottingham. The Meteorology of, for the year 1897, by Arthur Brown, M.Inst.C.E., and Philip Boobbyer, M.B. Fp. *The Authors.*

Patent Office. Abridgements of Specifications, 1889—92. Class 4, Aëronauts, &c. 7, Air and Gas Engines. 23, Centrifugal Drying, &c., Apparatus. 32, Distilling, &c. 33, Drains and Sewers. 41, Electrolysis. 4to. London, 1898.

——— Abridgements of Specifications, Period 1889—92. Class 8, Air and Gases. 17, Boots and Shoes. 27, Coin-freed Apparatus, and the like. 34, Drying. 37, Electricity, Measuring and Testing. 38, Electricity, regulating and distributing. 48, Fish and Fishing. 4to. London, 1898. *H. M. Patent Office.*

Ransome, *Arthur, M.D., F.R.S.* Researches on Tuberculosis: the Weber-Parkes prize Essay, 1897. 84 pp., 8vo. London, 1898. *Smith, Elder & Co.*

Reid, *G., M.D.* On Sewage Disposal at Tipton: being Extract from Monthly Report of the M.O.H., Nov. 6th, 1897. 10 pp., 8vo. *The Author.*

Roechling, *H. A., Assoc.M.Inst.C.E.* Sewer Gas and its influence upon Health. 224 pp., 8vo. London, 1898. Biggs & Co. Price 5s. *The Publishers.*

Spinks, *W., Assoc.M.Inst.C.E.* House Drainage Manual; a guide to the design and construction of systems of Drainage and Sewage Disposal from Houses. 318 pp., 8vo. London, 1897. Biggs & Son, price 5s. *The Author.*

Stratton, *F.* Public Health Act, 1875, and other Statutes and parts of Statutes relating to Public Health. 8vo. London, 1898. Knight & Co., 7s. 6d. *Purchased.*

Switzerland. Statistique de la Suisse. 112^e livraison: Mariages, Naissances et Décés en, de 1871 à 1890. Deuxième partie les Naissances. 137 pp., 4to. Berne, 1897. *Bureau de Statistique.*

United States Army. Index-Catalogue of the Library of the Surgeon-General's Office. Second Series, Vol. II. B—Bywater. 954 pp., 4to. Washington, 1897. *The Surgeon-General.*

NOTES ON LEGISLATION AND LAW CASES.

Prepared by Dr. H. Manley, M.O.H., West Bromwich.

IN THE HIGH COURT OF JUSTICE.—COURT OF APPEAL.

(*January 26th*, 1898.)

Before the LORD CHANCELLOR, LORD JUSTICE A. L. SMITH, and LORD JUSTICE COLLINS.

WOOD *v.* MAYOR, &c., OF WIDNES.

This was an appeal from the judgment of a Divisional Court (Mr. Justice Lawrance and Mr. Justice Ridley), on a case stated by two Justices of the County of Lancaster (reported in 13 *The Times* Law Reports, 537). Mr. Edwin Wood was the owner of certain houses, 52 to 68, Terrace-road, Widnes. At a petty sessions holden at Widnes, a complaint was preferred against him by the Corporation of Widnes, acting as Urban Sanitary Authority, under section 36 of the Public Health Act, 1875, claiming payment of certain private improvement expenses in respect of slop water-closets fixed at his houses. The Justices adjudged that the Corporation should recover the sum claimed. The facts were as follows:—On February 12th, 1895, the Urban Sanitary Authority confirmed the following resolution of the Health Committee:—"Waste-water-closet system.—Resolved,—That in all future cases of nuisances requiring the reconstruction of privies and ashpits the Local Authority of this borough do, as far as practicable, order that such privies and ashpits be converted into the waste-water-closet system, or into such other water-closet system as the local authority may from time to time approve, and that the Highway Committee be requested to take such steps for the adoption of the first-named system generally throughout the borough." On March 22nd, 1895, the Corporation's Inspector of Nuisances served upon Wood a notice requiring him to abate a nuisance at his premises, 52 to 68, Terrace-road, by converting the privies into water-closets.

On April 3rd the Inspector reported that certain houses in the borough, including Wood's, were without a sufficient water-closet, earth-closet, or privy, and on April 9th the local authority confirmed a resolution of the Health Committee that notice might be served upon Wood and the other owners of the houses, requiring them to provide a sufficient privy and ashpit upon the waste water-closet system approved by the Corporation. On April 23rd notice was served upon Wood in accordance with the terms of this resolution, and, the notice not having been complied with, the local authority did the necessary work, and, then took these proceedings to recover the amount. It was contended for Wood that the resolution of February 12th, and the subsequent proceedings thereunder were invalid. The question of law for the opinion of the Court was whether the resolution of February 12th was valid, and, if not, whether it invalidated the subsequent proceedings. The Divisional Court allowed the appeal raised on the case stated, holding that the local authority were not entitled to lay down a general rule to be applied in all cases without regard to the particular requirements of individual houses, and had no power to order that only one particular kind of water-closet should be used. The Corporation appealed.

Mr. McCall, Q.C., Mr. Macmorran, Q.C., and Mr. Bonsey appeared for the Corporation; Mr. C. A. Russell, Q.C., and Mr. F. W. R. Rycoft for Wood.

The Court dismissed the appeal.

The Lord Chancellor said it was admitted on the part of the Corporation that a local authority, when proceeding under Section 36 of the Public Health Act, was bound to exercise a discretion in each particular case, and had no right to impose a new scheme of sanitation on a district generally. The only question to be decided now was whether upon the facts of the case the local authority had complied with the statute so interpreted. He came to the conclusion that there was here an effort, without having regard to each particular case, to enforce on the district a uniform scheme. On that ground the judgment ought, in his opinion, to be affirmed. Further he thought that the notice which had been given to the respondent in this case was not a good notice under the statute. It said in terms that, if he did not do a particular thing, he would not be complying with the notice. If there had been a note at the bottom suggesting that a particular kind of work would satisfy the Corporation, that, perhaps, would not have been improper. But if there had been the addition that nothing else would satisfy them, that would have been bad. In the present case it was worse still, for the particular requirements was made part of the notice itself. On both grounds—viz.: that there has been no exercise of discretion, and no proper notice—he thought the appeal should be dismissed.

Lord Justice A. L. Smith delivered judgment to the like effect.

Lord Justice Collins concurred.

Kenny & Co., Printers, 25, Camden Road, London, N.W.

Volume XIX.—Part II.] [JULY, 1898.

JOURNAL

OF

THE SANITARY INSTITUTE.

PURIFICATION OF WATER FOR BARRACKS, PRISONS, AND OTHER INSTITUTIONS.

By Prof. J. Lane Notter, M.A., M.D.

(Fellow.)

Read at Sessional Meeting, February 9th, 1898.

The subject which has been selected for discussion this evening and which I have the honour to bring before you, is one that interests us all. As you see from the heading of the paper, it is "The purification of water for barracks, prisons, and other institutions," and at first sight this title might seem to limit my observations to what is called domestic filtration. But wherever we deal with barracks and other institutions we require something more than ordinary domestic filtration with which to purify water, and we really have to consider the whole question of water purification.

Let me state at starting that it is absolutely necessary, as I shall show later on in quoting some experiments I have made, that from whatever source a water supply is taken that source should be above suspicion. I think that no system of purification that we can adopt will render a water supply under all conditions perfectly safe. Take for instance filtration on a large scale; we have got influences of climate, influences of frost, and conditions regarding organic matter in the water to deal with. And again, when we employ filtration on a small scale we have got other circumstances to consider which I shall have to refer to afterwards.

Now first and foremost I shall to-night treat the subject of filtration more with reference to institutions and barracks than on a large scale. The latter subject has been sufficiently, and perhaps exhaustively dealt with by others, so I shall limit

what I have to say simply to barracks, prisons, &c. Now, a suspected water is generally purified by filtration, either on the ordinary non-pressure system or with pressure. Filters may be divided, then, into those which are used with pressure and those which are in use without pressure. Now of the most common filters in use without pressure perhaps animal charcoal is that which has been up to the present used more than any other substance. Animal charcoal, as you know, is a substance procured by burning bones; it has the power of condensing oxygen within its pores; one cubic inch of animal charcoal takes up as much as ten cubic inches of oxygen and condenses it. Charcoal holds this condensed oxygen within its pores to oxidise any organic matter which may be present in the water. Organic matter, as you know, is composed of carbon, hydrogen, nitrogen, and sulphur and the oxygen in the charcoal has the effect of oxidising this organic matter. Animal charcoal simply changes the nature of the organic matter and is said on that account to render it harmless. If this were all that was needed, animal charcoal would to a large extent fulfil the purpose required of it. But something more is added besides oxygen; animal charcoal contains phosphates and nitrogen, and I have no hesitation in affirming, from experiments, that it forms an admirable breeding ground for micro-organisms; certainly the number increases after passing through animal charcoal, and we consider it, therefore, an unsafe medium for water filtration. It also has another objection—that vitalised, *i.e.*, fresh organic matter passes through animal charcoal and appears to go through it unchanged. Dissolve albumin in a portion of water, pass it through animal charcoal, and what is the result? It passes through almost unchanged. But if you allow that organic matter to decompose, if you allow a certain amount of decomposition to be set up, the animal charcoal appears then to remove the greater part of it, at least so far as we can judge by chemical analysis afterwards. So much for animal charcoal.

The next and perhaps the substance most in use after charcoal is spongy iron—*i.e.*, hœmatite ore heated short of fusion—which appears to exercise its purifying mission from the fine state of division in which it exists. When water is passed through spongy iron it is broken up, being acted on chemically, the hydrogen is given off, and the oxygen goes to oxidise the organic matter in exactly the same manner as animal charcoal. Spongy iron removes on the average from 40 to 50 per cent. of the micro-organisms, but increases the free ammonia, and also has a tendency to cake, and the water then passes down between the sides of the vessel and the filtering medium. Unless it is kept constantly wet this is very liable to occur. It also adds iron to

the water, which is subsequently got rid of by means of black oxide of manganese, sand, gravel, etc., and unless these are carefully handled they all get mixed up together, with the result that the removal of the iron from the water is rather imperfectly done. The chief objection to spongy iron is that it does not sterilise water. Again, we have in use those filters which are seen in the Navy, the filtering medium being composed of carbon, ferrum, and albuminum, the name carferal is given to it. This has also the objection that although it does not add anything injurious to the water, it does not sterilise the water. In fact I hardly know any small filter suitable for domestic purposes—I know of no substance that will sterilise water, if non-pressure filters are used. The filters we come to are pressure filters; for example, the Pasteur-Chamberland and the Berkefeld filters. The Pasteur-Chamberland filter is made, as you know, of china clay in which the pores are extremely fine. Now in every experiment that I have made the Pasteur-Chamberland filter has sterilised water. I have never found an instance in which the filter failed, except upon one or two occasions when a personal error entered into the experiment. The difficulty about the Pasteur-Chamberland filter is generally in connection with the joints, and where we have to deal with it, for military purposes at least, this forms one of the chief objections to that filter. In the system the liability there is to fracture when carrying these filters about, the difficulty of plugging up the holes afterwards, and the slowness of the rate of filtration tend rather to limit the usefulness of the Pasteur-Chamberland filters for military purposes. On the other hand, for barracks and perhaps for other institutions where proper supervision can be carried out, where they can be put up and have not to be moved and plenty of time can be given for filtration of the water, they are, I believe, one of the best class of filters that we have at the present day.

One or two points in connection with the Pasteur-Chamberland filter are important. If you look at one when it is broken across you will find that the thickness of the material is not perfectly even; well, that is a defect in making, and there is no reason why it should not be overcome. My own idea is that we should get a much more rapid filtration, and perhaps equally good, if the material were not quite so thick as it is in the bougies, which are generally supplied in filters of this class.

The Berkefeld filter also sterilises water, and I may say of it that under no circumstances have I found that filter to fail. It is more rapid in its delivery than the charcoal filter, but for military purposes it is perhaps not so good as the Pasteur-

Chamberland filter. It is more friable, more likely to break and less easy to clean.

The great difficulty we have with these filters is in regard to this question of cleaning and keeping them in order. It may be possible in civil life, in prisons, and in institutions of that sort to get a man or one or two men to acquire a knowledge of the circumstances under which they may be used, to learn how to clean them, how to regulate them, how to keep them in order, so that they may always act as they ought to do. But in military life it is extremely difficult to get soldiers to do this sort of work; they are constantly on the move, constantly changing from station to station, and are utterly careless, if I may say so, as to whether water is filtered or not. It would be extremely hard to get them to give the attention to these filters which is absolutely required. Again, except where public water supplies are to be had we never can use these filters because they require pressure, I may say constant pressure, in order to drive the water evenly through them so as to obtain the best results. I may add that the pressure must not be excessive, because if the pressure be too great we find that in time the micro-organisms themselves are driven through the filters.

These two classes of filter have no chemical action on water, they simply sterilise it; they do their work well, and if proper attention is paid to them they seem to afford every security so far as water is concerned. If, however, you are dealing with the class of water you get abroad, water quite different from that which you get at home, where there is a large growth in the water of *desmidiæ* and *diatomaceæ*, rapidly flourishing under a high temperature, these filters get coated and in a comparatively short time the water ceases to pass through them. Of course, this could be obviated by constant cleansing of the filter. These filters furnish us with the means we have for purifying water at the present day.

I have not gone into the question of sand filters, which most of you know of, because it is rather in connection with large town supplies that they are used. However, in smaller districts, for schools, barracks, and prisons, a sand filter often proves invaluable. I know one institution not a hundred miles from London in which a sand filter was put up some years ago by Mr. Rogers Field, who is well known in the Sanitary Institute, which has worked perfectly and from which the water issues nearly sterile. It has a most admirable purifying effect upon the water which passes through it.

There is one point in connection with this subject which I should like to impress upon you all, and that is that there should be no duplicate water supply in any place. Where you get two

systems of water supply, one filtered and one unfiltered, you are always in danger of something occurring. Ordinary individuals will not distinguish between one tap and the other, and such a system is certainly to be deprecated. Again, may I say that the placing of a number of small filters for any institution is not to be commended. The multiplication of filters is a thing which we all decry. It is one of the evils of the olden days when filters were upon every landing almost in every barrack, never taken down and supposed to last for a lifetime, adding impurity to the water instead of removing it. The water supply to large institutions, to barracks, prisons, hospitals, and other places in which there are a large number of people congregated ought to be supplied filtered on a large scale and fit for drinking, and as far as I know the best means of filtering on a large scale is certainly through sand. I have seen this on several occasions and in many places. A sand filter properly constructed, properly laid, with sufficient depth, and the rate of flow through it so guarded as not to be excessive will yield water as a rule pure, unless at the source the water is in an exceedingly bad condition. Sand will certainly render ordinary water potable in the majority of cases. But there are certain conditions in which we cannot depend upon filtration at all; such conditions are seldom to be found in civil life, but are frequent in military service, and the means of dealing with them may be at times useful in civil life.

Now, is it possible to add anything to water that will render it absolutely sterile? Is it possible under our present knowledge of infectious disease to render water sterile without submitting it in any way to a filtering action? I have been lately making some experiments with regard to this, and they have been so far as I have gone eminently successful. But I found certain conditions and certain things occurring during this series of experiments which perhaps increase one's knowledge of the whole subject. In Germany a few months ago—eight or ten months—it was suggested to sterilise a suspected water with a solution of bromine, and afterwards to decolorise it by using a solution of hyposulphite of sodium. I have made a series of experiments to test this sterilising action of bromine, as it would be invaluable in many cases in which filters failed, or in which filtration was not possible. I won't weary you by reading over the details of all those experiments, which I have here, but they were done very carefully, under conditions which I think admit of no fallacies. The idea of the experiments was to place a certain quantity of typhoid bacilli (*Bacillus Typhosus*), in water after incubating it in a bath at a certain temperature, to try whether by the addition of a certain quantity of bromine,

you could sterilise that water. (*a*) 100 cc. of distilled water were placed in a sterile flask and one loopful of a growth of *Bacillus Typhosus* added, and diffused in the water. After incubating the flask at 37°C. for 48 hours a gelatine plate was made with 1 cc. of the water and incubated at 22 degrees C. (*b*) ·2 cc. of the working solution, that is, ·06 grammes of bromine per litre, was then added to the flask. At the end of five minutes the water being still coloured with the bromine solution, a gelatine plate was made with 1 cc., and incubated at 22 degrees C. At the end of 48 hours plate (*a*) showed numerous typhoid colonies, plate (*b*) was sterile. After incubation for 7 days plate (*a*) had become crowded with colonies, but plate (*b*) showed no growth, and has remained sterile up to the present day. Plate (*b*) was the one treated with bromine. This experiment was made with distilled water. I then made a second series of experiments with stream water, that is, a water highly polluted. The *Bacillus Typhosus* was added to the stream water and incubated at 37°C. for 48 hours. A gelatine plate was then made with ½ cc. (plate *a*). To 100 cc. of the stream water and *B. Typhosus* ·2 cc. of the working bromine solution was added and incubated for 48 hours; after five minutes a plate was made with ½ cc. (plate *b*). The incubation was continued for several days; plate (*a*) rapidly liquefied, and plate (*b*) treated with the solution showed after a week's time only one mould and a colony of *Proteus Vulgaris*.

Then it occurred to me that it was possible the organic matter and free ammonia in the water had so reduced the strength of the bromine that they actually prevented its acting in such dilute quantities as I had hitherto worked with. I therefore made a further experiment, by taking a series of working solutions, and adding them to artificially polluted water, making a chemical analysis at the same time. I found that what I had suspected had really occurred, *i.e.*, that the organisms present in the water and the organic matter required more bromine solution than I had calculated on, and by increasing this to a very small extent I found that I sterilised the water completely.

The following experiment was arranged to test the power of bromine on a water containing *B. Typhosus* and artificially polluted with broth (non-sterile): four sterile flasks were taken and into each 100 cc. distilled water, 2·3 cc. broth, and one loopful of a growth of *B. Typhosus* were placed. The flasks were labelled (*a*), (*b*), (*c*), and (*d*), and then incubated at 37° C. for 24 hours. The next day, for control purposes, gelatine plates were made with one cc. of the contents of each of the flasks, then—to flask (*a*) ·2 cc. of the working solution of

bromine was added (·06 gr. per litre); to flask (*b*) ·3 cc. of the working bromine solution was added (·09 gr. per litre); to flask (*c*) ·5 cc. of the working bromine solution was added (·15 gr. per litre); to flask (*d*) ·6 cc. of the working bromine solution was added (·18 gr. per litre). At the end of five minutes gelatine plates were made with one cc. of the contents of each flask. All the plates were incubated at 22° C. The first series of plates, *i.e.*, the control plates, rapidly liquefied; the second series showed no growth for 48 hours; after 72 hours liquefying colonies appeared in the plates from flasks (*a*) and (*b*). After 96 hours the plates from flasks (*a*) and (*b*) were liquefied, but the plate from flask (*c*) showed only one colony and flask (*d*) remained sterile. After seven days' incubation the plate from flask (*c*) still showed only one colony, and the plate from flask (*d*) still remained sterile. I made a chemical analysis of the water with which I had been dealing, and the result of that chemical analysis showed that it contained 3·753 parts of free ammonia per 100,000, and 9·5 parts of albuminoid ammonia per 100,000, that it was more highly polluted than a water one would be likely to get from the effluent of a sewage farm.

Now from these experiments it appeared that bromine, present to the extent of ·06 grammes per litre, would destroy *B. typhosus* when present in a water polluted to a greater extent than a sewage effluent or any water that is likely to be used for drinking purposes. Having arrived at this result, the next point I had to deal with was how to get rid of the colour and taste of the bromine. This was done by adding to each litre of water containing the ·16 grs. bromine, sodium hyposulphite 0·095 gramme and sodium carbonate ·04 gramme. The colour immediately disappears; the water had a pleasant sharp taste, and no odour of bromine whatever could be detected in it.

In mentioning these experiments, there are one or two things which strike one in them. We often hear about the antagonism which exists between chemical and bacteriological examination. In truth, one helps the other; one is largely dependent upon the other. I could not help noticing in these experiments—I have only quoted the results of a few of them here, they numbered upwards of 40 altogether—how much the presence of organic matter in the water influenced more or less the growth of the pathogenic forms in that water. In perfectly pure distilled water the *B. typhosus* appeared to have no power of multiplication whatever; but if you added to that water a broth culture, *i.e.*, if you made that water impure, and gave to it the characteristics of polluted water, the bacilli not only remained in the water but appeared to increase in number.

We often hear it said that a chemical analysis gives us no indication; I think on the contrary it gives us a very excellent indication; it tells us under what conditions a specific organism introduced into water is likely to spread, multiply, and propagate itself. In pure distilled water, a water which we call chemically pure, these organisms do not appear in any way to increase; whether they die out or not I am not at present quite certain. Certainly they do not appear to increase as far as my observations go, and it shows us that after all we must rely to a large extent on chemical analysis to show us the condition of the water, and on bacteriological examination of the water to define what the organic matter really is, whether it is due as it may be to animal life or simply to vegetable material.

Now, this principle I have tried to explain to you to-night is one which has been exercising our thoughts a good deal lately on account of the excess of enteric fever in India, where it is impossible to resort to the system of filtration and those means of purifying water which we find here in England at the present day. If we can, by adding to water some such solution as I have here foreshadowed, and render that water sterile, I think we may perhaps to a certain extent reduce the mortality from that disease in India and other tropical countries where it has proved so fatal.

There is another method which is being introduced—I am not sure by whom—and I have been making some experiments with it also. It was suggested to me as coming from Vienna last year; it promises results, but certainly they are not so good as those I have already mentioned. I allude to calcium hypochlorite. The great difficulty I have found with this substance is its insolubility. Water, containing ·02 grs. of this substance per litre, was seeded with *B. Typhosus;* plates were made and incubated and remained sterile after seven days. The experiments which I made may be briefly summed up as follows: *B. Typhosus* was placed in distilled water and incubated 24 hours at 37° C., plates were then made and numerous colonies of *B. Typhosus* grew after 48 hours' incubation; calcium hypochlorite was then added in the proportion of ·02 per litre; 15 minutes later plates were made and incubated at 22° C. and the plates were still sterile after 10 days' incubation.

The third series of experiments was: water polluted with broth, seeded with *B. Typhosus*, and incubated at 37° C., it became crowded with colonies; calcium hypochlorite was added and after 15 minutes plates were made, and no growth has yet appeared on the plates, although they were made 11 days ago. These experiments are very recent and I do not know whether the plates will remain sterile for any time. I should be sorry

to accept the results yet, and simply give them as perhaps somewhat a new departure in the lines of purifying water.

Now, I pass on from this method of chemically—if I may so call it—sterilising water to that system which is one of the oldest and well known to you all, that is, submitting water to the action of heat in some form and thus sterilising it. From my own experiments, I think that water can be sterilised for all practical purposes without boiling it. My colleague, Professor Wright, has been making some experiments upon the typhoid organism. I have been doing the same. We both have found that in making the typhoid vaccine you can destroy the organism at a temperature somewhat between 60° or 65° C. I now think it is not necessary to quite boil the water. I am perfectly satisfied that if it is raised to 60° or 70° C., as regards the micro-organisms of cholera aud enteric fever it is practically rendered sterile. The plan which has been in use in military life for military purposes generally, and also in many civil districts—as at Maidstone—has been simply to boil the water, and perhaps after all there is no simpler, no surer, and no better method, if people will only do it, than simply to boil water to render it sterile. But boiling takes time, and when you have to deal with the community at large you will find that they do not often wait for water to come to the boil. And as far as soldiers are concerned, the soldier is very apt to stick his mug, or whatever vessel he has, into the water and take it away long before it reaches the point at which water is rendered safe.

There have been one or two methods of late introduced. I have no practical experience of them; they are under investigation now. In this direction, Monsieur Desmaroux's apparatus, which may be seen in the corridor of the Museum, is under investigation at Netley for the War Department, but we have been unable to make any experiments with it yet. However, his principle is sufficiently interesting, to allow me to mention it here, although I have no practical knowledge of its results, or of what it does. It simply consists in taking water at a certain pressure, and heating it in caissons to a temperature of about 100° to 120°C. as required; the incoming water cools the water passing out, and obtains a certain amount of heat before passing into the caissons. Now, the great advantage of this, as far as one can see, is the rapidity with which the sterilisation—if the water is sterilised—is performed. I have no reason for saying it is not sterilised, because I have no practical experience of it. But from the experiments which have been made, the results of which have been placed in my hands, it appears that it does sterilise water. The great advantage is the rapid

delivery, and as far as we in military service require water, the system is no doubt a sound one and the principle upon which it is worked good. One can state as far as I understand it that none of the dissolved gases in the water escaped; the water certainly that I tested appeared to differ in no way from that which went into the steriliser; it was apparently as well ærated, as far as physical characteristics could be discerned, as that which went in; but I have no further knowledge as to whether it absolutely sterilises water. Knowing, however, the conditions under which pathogenic organisms can be sterilised in water, I think there is no doubt, if it is submitted for 7, 8, or 10 minutes to the temperature of 100° C. to 120° C., it is rendered comparatively sterile and free from danger. But I cannot speak with more certainty of it than this, because the matter is as far as I am concerned *sub judice*, but it appears to me that it supplies a want which we all have up to the present experienced. For I confess honestly that of all the questions that have bothered me for years past the most difficult one has been the purification of suspected water supplies, where we have young men, such as soldiers, to deal with, depending possibly upon sources which are anything but advisable.

With these few brief observations I venture to place the subject before you, in the hope that it will lead to some discussion; for it is a subject which interests us all, a subject which at the present day stands, I may say, almost in the forefront of sanitary work. We see around us day by day a number of cases of enteric fever; one cannot help noticing that even here in London there is more enteric fever than there ought to be. Anyone who has studied those admirable charts which the medical officer for the County of London, Mr. Shirley Murphy, has prepared, cannot fail to see that there is a very close relationship between the increase of enteric fever, or at least its prevalence, in London, and the conditions of the water supply. I hope that someone who has had practical experience of this very interesting subject will enable us to come to some broad conclusions with regard to it and help to diffuse useful information.

Rev. F. Lawrence (Westoe Vicarage) said he was the Chairman of a Council in the East Riding, and their small village suffered from inferior water. He was Vicar of that parish and Hon. Secretary of the Church Sanitary Association, whose object was to aid the clergy in taking an active interest in sanitation. The Church Sanitary

Association sought to teach the necessity, *inter alia*, of a pure water supply. They had had a magnificent sermon that evening, and he wished it could have been delivered in every cathedral, in every church, and in every chapel in the United Kingdom, and indeed wherever English was spoken. If it was wrong for parents to neglect the education of their children, it was worse to give them water to drink which might kill them. There was a moral responsibility in regard to a pure water supply, and this truth ought to be driven home by every minister of religion and every teacher. The Founder of their religion cared as well for the body as the soul, and this concern for the temporal welfare of the people manifested by the Christian Church was increasing in influence in every part of the world. It was to be hoped that all Christians would be taught that it was their duty to care as well for the body as the soul.

Mr. Wolff Defries (London) remarked that he had little to contribute to the discussion, if discussion were possible on a paper in which so much must commend itself to those who had any experience on the subject. He had listened to Professor Notter with considerable edification, for the paper gave in practical form the net result of many things which had been floating in the air. As to the practical possibilities of the Pasteur filtration on a large scale, which he was in a position to discuss from a technical point of view, he thought that they had not quite said the last word on the subject of this class of filtration. It had been the constant policy of those who, both in France and in this country, were concerned in introducing that method, after having once successfully contested their patents in the courts of law, to refrain from preventing the use of any cognate materials which might infringe those patents, in order that a parent patent should not affect so important and vital an interest, placing the whole community upon the intelligence and efforts of one set of men. It was therefore possible that analogous filters to the Pasteur might arise and present its advantages in even an improved form. He thought, however, that bacterial filters in their present form were adequate to the purposes contemplated by the paper. The defects to which Professor Notter had alluded mainly referred to the mechanical construction of the filter cases, and had been remedied by now. For instance, the question of joints. When Professor Notter spoke of the joints, he doubtless had in his mind the portable and not the fixed form (Professor Notter: Quite so.) As he knew the man who made the portable joint, and the circumstances under which it was made, he thought he might say that the joint was an improvisation made under urgent demand was decidedly unsuccessful, but there were obvious means of making a joint of a filter of whatever size sound and practicable. Then slowness was urged against this class of filter; but he had never known it to arise except from one cause—the attempt to get a higher duty out of the filter than the nature of the water allowed. If they had regard to the nature of the water and put in a filter of a proper size, his own experience was that with this class of filter any quantity of water could be got,

and that there would be no trouble in the working. In India, from reports that were continuously sent to him, the use of these filters had extended enormously. A number of jails had adopted this particular system and it had worked efficiently, satisfactorily, and without trouble. He mentioned this result not so much in criticism of the particular apparatus that happened to be installed, as an evidence of the fact that when installed by competent persons with due regard to size, bacteriological filtration gave a serviceable and practical result. He desired before passing from the subject of filtration to offer a word of caution. The manufacture of a bacterial filter is at present a purely empirical business. The substance used is a complex mass of various materials, and is not merely china clay; and it requires the highest skill in pottery to produce a uniform result in respect of sterilising capacity. It was the difficulty of obtaining a trustworthy result which accounted for the fact that Pasteur tubes, for example, have up to now only been produced in the cylindrical form, great as the temptation is to produce them in other forms. When they heard from Professor Notter that Pasteur filters which will be found invariably sound can be produced one after another it did not mean that this occurred by accident or was a simple matter. It was due to a constant sedulous supervision, an accuracy of manipulation, exercised under the control of a master potter who had made the subject his special study for over fifteen years; and with all this skill some thirty per cent. of the finished tubes were rejected on test. In contemplating a possible alternative, it was therefore of quite as much importance to have adequate guarantees of this inflexible and competent control as to obtain an adequate intrinsic efficiency in the material itself. He could not conceive anything more disastrous to the progress that has undoubtedly been made in water purification than the admission of possible alternatives to satisfactory methods on the ground of laboratory examination of individual examples that were satisfactory, without obtaining complete evidence that such control in manufacture was exercised, and that the articles supplied in general commerce were identical with those furnished to laboratories and to firms who habitually supply laboratories; and while personally he felt every desire that this industry should prosper and extend to the creation of other types of the same kind, he felt that it was only on that condition that it could do so. He had spoken much longer than he intended, and could only attribute it to the fact of the suddenness with which he had been called upon. In the language of some old French writer he could say that if he had had more time to think it over he would have spoken at less length. The point for him as a practical man was, supposing he had a water supply for an institution or a field expedition to fit with an apparatus for sterilisation, should he suggest an apparatus worked by heat or one worked by filtration? In regard to the question of filtration in field service the amount of practical experience available was not large, and he would sooner be guided by the experience of Professor Notter than he would by his own. But he saw no theoretical reason why an efficient method of cold sterilisation by filtration could not be pro-

vided by existing means, and it was his personal belief that it could. He was perfectly ready to admit that so far as field service is concerned, where the filter had to be carted about, a single filter used for several hundred men, and there were difficulties of transport, filtration is not an easy matter. On the other hand, he was quite certain that sterilisation by heat on any substantial scale was, from a mechanical point of view—he would not discuss the bacteriological question—also not an easy matter. Practically one might call the apparatus mentioned by any name one chose, but they were the same thing—steam boilers with regenerative chambers attached. Professor Notter had alluded to this as a recent invention, but as a matter of fact the general arrangements dated back a good many years, ten years Dr. Rideal told him. The first real application of the principle of which he was aware was that of the late Charles Herscher, who certainly did as much as most men on the question of public disinfection. He had before him a diagram of the apparatus that gentleman used; it consists of a heater in which there are the annular chambers, the water circulating through them and going through concentric spiral tubes; the hot water goes out and meets the incoming current of cold water; the whole thing worked out on the regenerative principle. He had no hesitation in admitting that he had had occasion to consider how far that apparatus would be adaptable for the purposes of a field expedition, and how far he should be justified in asking the authorities to consider this as one of the practicable alternatives. Acting in some measure on independent expert advice, with which his own opinion concurred, he came to the conclusion that to send a man out with a piece of machinery involving a steam boiler and certain other things into the desert where the materials for repairs were not available, where if a tube burnt out it could not be replaced, where those mechanical difficulties which would crop up where there was steam under pressure could not be readily dealt with on the spot, and the future of the water and the health of the troops might be compromised in consequence, was a step not to be taken until every other means had been exhausted. On that ground he did not feel justified in asking the authorities who might be interested to consider this system for the regenerative sterilisation of water. The apparatus they saw that evening appeared to be an elegant adaptation of that particular principle. He had no doubt that within the limits of strength and lightness—and the margin of strength in the case of rough transit was large—it would be an alternative well deserving of consideration. But one point must not be overlooked: where they had a current of sterilised water passing through a number of continuous partitions separating it from the unsterilised water, it was necessary to have something very substantial in the nature of a joint. Little more was suggested in this than a cement joint, but an apparatus with fifteen feet of cement joint was liable to risk at some point; a leak would put the sterilised and unsterilised water into communication, and although he admitted the flat surface gave a larger cooling surface than one with spiral tubes, he thought it was a question to be considered whether spiral tubes would not be in

the long run more satisfactory as giving a sounder joint. He merely mentioned this point as a consideration to be borne in mind in regard to the possibility of sterilising by heat for field service, but in considering the application to institutions with a large supply he had much less doubt. It would require very exceptional circumstances to induce one to recommend the sterilisation by heat on a large scale rather than sterilisation by cold if it can be conveniently arranged. Installations of hundreds of thousands of gallons had been erected for cold sterilisation, and he saw no reason why there should be any limit to the amount. In particular, the introduction of plant working with vacuum instead of pressure had enabled unlimited quantities to be obtained without the increase of weight which was inevitable in a pressure system. These remarks were, as he hoped one's remarks on such matters always would be, applicable to no one system or apparatus. It must be taken as applicable both to any system of cold filtration which satisfied the bacterial and practical conditions, and to any system of regenerative sterilisation which was open to the criticisms he had made. Other things equal, one would naturally prefer a process which does not require heat, and judging from his experience of the last three years and the accumulation of experience generally, especially in this country, he did not think there was ground for questioning the practicability of purifying water on whatever scale by means of cold sterilisation. That sedulous attention to which reference had been made was only required in installations where it was attempted to get more water through the tubes than the quality of the water allowed. He thought, in conclusion, that they would find that cold sterilisation will continue to be the favourite and best accredited method of purifying water.

Dr. S. Rideal (London) observed that the subject was one upon which he did not feel qualified to speak, because he had had no experience of barracks nor of prisons. He supposed that on the whole in prisons the amount of water drunk per head of the population would be greater than in barracks, and it would be interesting to ascertain the statistics in regard to institutions of that character compared with the quantity used for drinking purposes in municipalities and towns. With regard to filters, animal charcoal was very much maligned and was looked upon as a thing of the past. But Professor Notter in his criticisms of the disadvantages of animal charcoal mentioned a fact apt to be forgotten, viz., that substances like albumen will pass through a charcoal filter without being in any way acted upon, whereas the products of the putrefaction of such albumen—ptomaines, poisonous bodies, enzymes—are oxidized by such animal charcoal. Unsatisfactory as it was in some respects, animal charcoal was in other respects a very desirable filter, inasmuch as it oxidises the ptomaines or poisonous substances which may be present in the water. Such advantages could not be claimed for spongy iron; in fact, it increased the ammonia. The author's description of Mr. Rogers Field's sand filter was most interesting, for they were told that it had been worked a number of years and

practically yielded a sterile filtrate. That was a filter which should be a model filter for every water company in London to imitate.

PROFESSOR NOTTER: Of course the sand has been changed several times.

DR. RIDEAL said this showed that sand filtration was possible, and, as it gave remarkably good results it was a pity that sand filtration as a rule did not give such good results as Mr. Field succeeded in obtaining from this particular sand filter. He was not quite certain whether he agreed with Professor Notter in regard to the duplicate supply. Under certain circumstances a duplicate supply was desirable. In large towns where one could have a supply of sterile water for drinking purposes, it seemed a waste of money and time to sterilise the water used for flushing closets and sewers, or in case of fire. In dealing with barracks or prisons it was, however, quite possible to sterilise the whole water supply of such a small community; but in dealing with large towns he fancied a duplicate supply was well within health considerations at the present time. He agreed as to the undesirability of having several filters in different parts of a building; it was certainly the proper thing to have the whole system in one place, either as a battery of filters, or, if possible, sand filtration of the quality obtained by Mr. Rogers Field, so that the whole supply would be under one control and managed by one official. If he were advising for barracks or prisons he should say put in a supply of bacterial filters. There had been a question of the different values of the bacterial filters on the market, but it was hardly necessary for him to go into the differences of the Pasteur-Chamberland and other filters of that class. Recently they had had a long report of Drs. Woodhead and Cartwright Wood on this subject for and against both the Pasteur and the Berkefeld filter, but personally he was inclined to favour the Pasteur-Chamberland filter, as the friability of the Berkefeld filter and the difficulty of cleaning it, militates very considerably against its use in practice on a large scale. Professor Notter had given them a great deal of information about the use of chemicals. The idea of using bromine for the sterilisation of water was by no means new. Thus Dr. Franck in 1883 used *Kieselguhr* impregnated with liquid bromine, and Fischer and Proskauer in their experiments also used siliceous earth. In 1886 Bromidine, a mixture of bromide, bromate and acid sulphate was suggested, as it liberated bromine when added to water; and in 1897 a patent was applied for (No. 8094) for making tabloids of such a mixture which could be added to the water before use. (See also Rideal, Disinfectants, pp. 72, 73; Altmann, P. 5793 of 1897; Schumberg, Ph. C., 38, 239; and *Deutsch. Med. Wochenschf.*, 1897, 407). Sodium sulphite and sodium hyposulphite had also been suggested as "antibroms." The objection to such a system was the consumption of a certain amount of bromine, which he thought would not be recommended by medical men. There were disadvantages about the use of bromine for sterilising water which did

not attend calcium hypochlorite, but it was only a modification of the old idea of using chlorine or bleaching powder for effecting the same purpose. Large quantities of bromine had to be added, for it was absorbed by the organic matter present in the water; this was apparently not the case with chlorine, a small quantity of which would reduce the number of organisms in the water very considerably, ·004 grs. of chlorine per litre was effective in reducing the number of organisms in sewage, and that was a very different matter to the ·06 grs. mentioned by Professor Notter. Very remarkable and interesting results had been obtained in recent years by Prof. Délépine and others in the germicidal action of chlorine. Potassium permanganate was another substance which seemed to be working wonderfully in India as a germicide. Dr. Hankin was reported to have used it successfully for dealing with cholera and the plague, and it might also be useful in the field for the prevention of enteric fever, especially as the typhoid organism is an organism which is very easily killed, although as a germicide permanganate had a low value. With regard to sterilisation by heat, Mr. Wolff Defries had mentioned that the regenerative principle was not new. The objection was that it is expensive, but it was to be remembered that if they could only for an instant bring an organism to the particular temperature at which its vital agency ceases, then no consumption of heat theoretically is required. It was therefore a question as to whether it was possible to ensure all the water passing through such a steriliser being raised to the necessary temperature, and then cooled down to the original temperature of the incoming water. He congratulated Prof. Notter on the valuable résumé of the subject which he had given.

Dr. C. Childs (London) said that Professor Notter had treated the subject in such an interesting manner that he was glad to add his thanks for the excellent paper they had heard. Paradoxical as it might seem, he wished to protest against the filtration of water entirely; for he cherished the hope that they would live to see the time when the filtration or boiling of water would be absolutely unnecessary. What he earnestly advocated was the protection of all our water supplies and the prevention of pollution. He was glad to hear the remarks of the Rev. Mr. Lawrence who opened the discussion, for above all things they required to stir up the people of this country and to insist that the water which we used should not be polluted with human excrement. He understood that in France there had been a very considerable reduction in the amount of typhoid fever in the Army since the introduction of the Pasteur-Chamberland filter, and he would be glad to know if any similar observations had been made in this country. The great objection to filtration was that however skilfully it might be done it could not be regarded as in any way perfect. They had had reports of the two classes of filters mentioned, and the defect seemed to be that of allowing micro-organisms sooner or later to pass through: the imperfection in these perfected filters seemed in fact to depend upon the human element—

the difficulty of keeping them clean. He should be glad to know whether any one could really say how these filters could be so cleaned that they might always be depended upon in ordinary life for yielding practically sterilised water. He would be glad if Professor Notter could give them an idea of what recommendations they had in the Army for cleansing these filters, whether they were content with a mere mechanical cleansing or whether they submitted the filters to boiling. For laboratory purposes they were accustomed to sterilise them in the Autoclave, or in Koch's steriliser. By boiling these filters sufficiently they could at any rate destroy any bacteria which might have passed into the pores. How often these filters should be cleansed was another pertinent question. Some bacteriologists would cleanse them once a week at least: whereas one eminent authority would allow the slime to accumulate on the exterior, and rely upon that slime for efficient filtration. He did not know whether the authorities were agreed on this point and gave instructions how often domestic filters were to be cleansed. How far could they rely on such instructions being carried out in ordinary life? With regard to bromine, he would not like to undertake to answer Dr. Rideal's question as to its injurious effect without knowing the definite quantity of bromine Professor Notter advocated for sterilising ordinary water. As far as he understood a very minute quantity of bromine was required for sterilising water more polluted than an ordinary sewage effluent, and he would not be called on to use so much for ordinary water. What was the quantity used for ordinary domestic water, and for water used in the course of a campaign when water had to be taken from rivers, &c.? The quantity seemed to him not sufficient to be worth taking into consideration as far as any therapeutical or anti-therapeutical effect is concerned. Dr. Rideal had suggested that ptomaines would pass through the filters unoxidised, but the quantity of these ptomaines would be so very small that they could not harm any human being; on the other hand a number of microbes, say the *Bacilli Typhosi*, which might pass through a charcoal filter would do infinitely more damage than a small amount of ptomaines formed by other micro-organisms.

Dr. Rideal (London) explained that he was not advocating the use of animal charcoal filters. What he did say was that water should be well oxidized before it went into the bacterial filters, then the ptomaines were oxidized.

The Chairman (Dr. Louis C. Parkes) in closing the discussion, said that with regard to bromine, he preferred that no chemical substance should be added to water with a view to sterilise it; if the water was not sufficiently pure to drink then it ought to be made pure by some other way than the addition of chemicals. The continual taking of small quantities of bromine or other substances added to water might in time have a considerable adverse influence on the health of water consumers. With regard to the heat sterilisation

apparatus they had been considering, he thought that there might be a future before it for certain purposes, but it ought to be very carefully considered from the point of view mentioned by Mr. Wolff Defries, namely the connections of pipes in the interior of the apparatus. It was quite evident that an apparatus which had such a great number of joints must be constructed in the first instance with very great care, and ought to be periodically examined to see that nothing went wrong inside, otherwise there might be established channels of communication between the sterilised and non-sterilised water. In concluding, he asked the company to accord Professor Notter a hearty vote of thanks for his interesting paper.

The vote of thanks having been passed with acclamation,

Professor Notter, in acknowledgment, thanked those present for the kind way in which they had received his paper. In answer to the question as to the exact amount of bromine he proposed to use, it was ·06 gramme to a litre of water. The amount he had previously mentioned was for the worst sewage effluent he could get, and he did not intend to use the same quantity for drinking water. For bad water ·06 gramme would be quite enough.

WATER-BORNE TYPHOID FEVER.

PAPER INTRODUCING A DISCUSSION,

BY CHRISTOPHER CHILDS, M.A., M.D.(OXON), D.P.H.

(Lecturer on Bacteriology in relation to Hygiene at University College, London).

(MEMBER).

Read at a Sessional Meeting on Wednesday, March 9th, 1898.

WHEN I was invited to introduce a discussion on "Water-borne Typhoid Fever," I felt that a great honour was conferred upon me, and, at the same time, a grave responsibility. One could not help wishing that the introduction of such a difficult and important question had been entrusted to one of greater ability and wider experience.

At the same time I felt conscious of possessing two qualifications (shared, I believe, by all those who have given much consideration to this subject), which have emboldened me to undertake the task assigned to me. The first qualification is the distress which, as a medical man, I have always felt on witnessing the vast amount of suffering, loss, and death, which is allowed to take place in this country through one of the most preventable of diseases; together with a loathing of the filthy habits through which such foul and widespread pollution of our springs, streams, rivers, &c., is still suffered to go on, and through which doubtless much of the prevalent typhoid fever is propagated.

The second qualification is the long cherished determination to do my humble best, whenever the opportunity came, for the abolition of this widespread pollution, and for the prevention of this destructive plague of typhoid fever.

In dealing with this question it will be convenient to consider separately three aspects of the subject:—

(1) Proofs that typhoid fever is frequently water-borne;

(2) Ways in which the infectious material is conveyed from the patient into water used for drinking;

(3) Means by which this pollution may be prevented.

The third of these (*i.e.*, the prevention of pollution) will be chiefly considered in this paper.

Ample evidence with regard to the convection of typhoid fever by water is to be found in the numerous reports to the

Privy Council and to the Local Government Board; in the history and summary of 205 outbreaks between 1858 and 1893 by the late Ernest Hart; in the careful records by Dr. Budd, and numerons other observers.

It must be admitted that in many of these records the evidence is very defective.

The custom is too common in this country to look only for a polluted water-supply as the cause of typhoid outbreak; to make no further enquiry when such pollution has been detected; and to rest content with this evidence as a positive demonstration of cause and effect.

The strength of proof, however, that the drinking water has been a frequent cause of outbreaks lies in the large accumulation of evidence, which, if not certain, is at least in the highest degree probable; and in the fact that in a considerable number of these recorded cases the evidence hardly seems to admit of any reasonable doubt.

Nature of the Typhoid Fever Poison.

The poison of typhoid fever is contained in the bodies of those suffering from this disease, especially in the discharges from the intestine, and in the urine.

The poison, in the opinion of our best authorities, consists of living organisms,—the typhoid bacilli,—and their products. These bacilli can grow and multiply in the body of man, causing the disease which we know as typhoid fever. After they have left the body of the patient these bacilli can grow and multiply in the surroundings and in the food of man, *e.g.*, in polluted soil, in water, and in milk.

They may thus become capable of infecting a very large number of people.

The poison of typhoid fever is very rarely conveyed directly from the sick to the healthy, excepting where there is neglect of cleanliness, of disinfection, and of ordinary sanitary precautions.

Ways in which the Typhoid Fever Poison may be conveyed.

The poison of typhoid fever may be conveyed from a patient to other individuals—

(1) By contact with the body, clothing, bedding, utensils, and other things which have been polluted with the discharges of the typhoid fever patient; unless care has been taken with regard to cleanliness and disinfection.

(2) Through the air, coming either from the soil, or from drains, sewers, cesspits, or other deposits which have been contaminated with the discharges from typhoid fever patients.

(3) Through ordinary food, especially drinking-water and milk, which have been exposed to air contaminated in the ways mentioned above, or have been polluted by deposits, leaking cesspits, drains, sewers, &c., containing discharges of typhoid fever patients.

It is probable also that the poison is not unfrequently conveyed through oysters and other shell fish which have been in contact with polluted water; and possibly through ices, watercress, and various other food materials which have not been cooked before being eaten.

That it is possible for the typhoid fever poison to be conveyed by any of the ways thus summarised will be generally admitted; but authorities differ as to which is the most probable, or the most frequent channel through which it is carried.

(I have myself recently had the opportunity of bringing before the Epidemiological Society of London the remarkable prevalence of typhoid fever in Munich up to the year 1880, and its rapid abolition from that city since that time. The history of typhoid fever in Munich indicates that the conditions of soil near and underneath houses may be an important factor in the production of typhoid fever, and that in tracing out the causes of an epidemic the conditions of the soil should not be overlooked. This possible source of typhoid fever has not received sufficient attention in this country.)

Whatever differences of opinion may prevail with regard to the most probable or most frequent channel of infection, we are bound to take all these possibilities into consideration in tracing out the origin of attacks of typhoid fever.

More than this, it is desirable to make allowance for some possible channel or manner of convection with which we are as yet unacquainted.

The Prevention of Pollution of our Water Supplies.

If, in dealing practically with the complicated problems presented to us in the outbreaks of infectious disease, we are to wait until we obtain absolute proofs of their origin and manner of convection, we shall remain continuously inactive.

However much we may doubt and differ with regard to the most usual origin and manner of infection with typhoid fever, we may at any rate predict this much—

That, if we make full and proper use of the acquired know-

ledge which is at our disposal with regard to the causes of typhoid fever, we shall reduce the mortality of that disease to a minimum;—from several thousands of deaths per annum in the United Kingdom to, at most, a few hundred, or even less.

That is to say, if we can ensure general notification of the disease, isolation of cases where necessary, complete disinfection of the patient and his excreta, protection from sewer gas and fæcal emanations, prevention of pollution of soil and of water with organic refuse and typhoid excreta, we shall every year in England and Wales alone save some 4,000 lives, prevent the prolonged sickness and suffering—otherwise to be expected—of some 40,000 to 50,000 individuals, and lighten the rates by some hundreds of thousands of pounds.

Of all the measures available for the prevention of typhoid fever, thorough disinfection, correction of insanitary conditions in houses, drains, sewers, etc., protection of the soil, and protection of water from pollution are the most important; and of these the last-named, the protection of our water supplies, is the one measure calling for immediate action.

Up to the present time little or no effective attempt has been made to secure a thorough and systematic prevention of pollution of our water supplies throughout the whole kingdom.

The clauses relating to water supply in the Public Health Act of 1875, the Rivers Pollution Prevention Act of 1876, and the Public Health (Water) Act of 1878 are practically quite inadequate for securing a general protection of our waters from pollution.

We rely chiefly upon our Waterworks Companies and our Sanitary Authorities for securing us against the introduction of poisonous material into the water with which the Companies supply us, and which we have to drink, if we drink any water at all. But under the existing state of the law, the obligations laid on the Companies, and the powers granted to the Authorities for thorough and constant supervision are so insufficient that we have little or no ground for such confidence.

For long we have adopted the pernicious habit of trusting almost entirely to Chemical Analysis,—more recently also to Bacteriological Analysis,—for detecting pollution; generally without investigating the surroundings of the source, of the tributaries, and of the course of the water supply; nearly always without securing the constant inspection and supervision which are necessary for the prevention of accidental, careless or wilful pollution of the water.

Even if the analyses were made daily they would not enable us to prevent pollution. They can only detect the pollution

after it has taken place. As a rule water-borne outbreaks of typhoid fever occur with explosive violence; so that most of the victims have imbibed the poison before the alarm conveyed by means of analysis can possibly save them from infection.

Combined with thorough and regular inspection of the water supply, from its source to its distribution, chemical and bacteriological analysis are of great service; for they can give indication of pollution which could not be detected merely by inspection.

If relied upon alone they give a false sense of security.

Too often the pollution of a water supply is detected by the occurrence of an outbreak of typhoid fever. Then it is realised, but too late, that the expenditure, which might have been made for the proper supervision of the water, would have been a very safe and wise investment; would have prevented much sickness, loss of life, and loss of money.

Chief Requirements for the Prevention of Pollution.

Thorough, systematic, and regular inspection of our water supplies, from their source to their distribution, is the first requirement for the prevention of pollution; such inspection being supplemented by analyses (chemical and bacteriological) made and reported on by experts at frequent intervals.

In order to secure thorough and reliable inspection it is essential that complete records of each water supply should be prepared and published. Such records should be fully illustrated by maps, plans, and sections, showing every source and tributary of the water, any reservoirs and filtering beds (if they exist), all conduits, mains, &c.; showing also the relations of all parts of the sources, tributaries, and course of the water to the surrounding rocks and soil; and to any houses, cesspits, drains, sewers, and other receptacles of organic refuse which may be in their immediate neighbourhood.

These records, maps, plans, &c., should be prepared and published by the Waterworks Companies (or other owners of the Waterworks) and should be made easily accessible to the local Sanitary Authorities within whose district the water is distributed, and to every customer of the companies.

The Waterworks Companies should be required to make constant systematic and adequate inspection of all parts of their water supply—from source to distribution; and should be responsible for the consequences of pollution, if such pollution could reasonably have been prevented.

The Sanitary Authorities should have free access to all parts

of the water supply for their district, for the purpose of inspection, taking samples for analysis, &c., whether the water be within or outside their district; and should be required to make adequate and regular inspection, and to publish reports regularly on the results of their inspections and analyses.

Wilful or careless pollution of any water supply should be regarded and treated as a penal offence.

Authorities, representative of the chief interests concerned, should be appointed for each watershed area of the kingdom, who should have the care and supervision of the waters within each respective watershed; should take prompt measures to prevent any threatened pollution, and to abolish any detected pollution of any water; and should be responsible for the administration of the laws respecting the protection of water within their district.

A study of the existing laws respecting water supplies and the pollution of water (as set forth in the Acts of 1875, 1876, and 1878) will show that they fall very far short of the requirements mentioned above. Probably the public are quite unconscious of the very inadequate protection which is afforded to them by these statutes against the dangers arising from the pollution of water.

No requirement is made in them for sufficient inspection and analysis of the water supplies, either by the Sanitary Authorities or by the Waterworks Companies; no free power of access to their water supplies is secured for the Sanitary Authorities; no responsibility for the consequences of pollution, which might easily have been prevented, is thrown upon the Water Companies; worst of all, as Major Lamorock Flower and others have frequently insisted, the powers for taking action against pollution are entrusted to the Sanitary Authorities, and these powers are enabling, not compulsory. That is to say, the Authorities have the power to take such action, but are not compelled to do so.

Now, considering that Sanitary Authorities are too often the greatest polluters, and are constantly subjected to the influences of local and vested interests, and to the incessant cry for the reduction of rates, it is not to be wondered at that the administration of these Acts has not been attended with success. For my own part, I cannot conceive how local Authorities, as at present constituted, could ever be expected to maintain a constant and complete supervision and protection of our water supplies; excepting those cases where the local Sanitary Authorities have wisely determined to purchase and take under their own control the whole of the watershed from which they obtain their water supply.

Most recently Torquay has set an honourable example by resolving to do this; an example which, it is hoped, will be followed by local Authorities wherever it is possible.

But such possibilities are exceptional; and if we are to deal with this important question as a national question, reforms such as I have advocated are imperatively necessary.

Can anything be more obvious than that additional and more effective legislation is required, and that the administration of the new Acts should be entrusted to an Authority who shall be required to carry out their duties without delay, and who will act without fear or favour, unbiassed by local interests and local jealousies?

It might be suggested that these duties should be entrusted to the County Councils.

But it is very doubtful whether they would find sufficient time or take sufficient interest to maintain the necessary supervision, and to enforce the observation of the Acts in opposition to local influences and local interests.

That the Authority, to whom the supervision and protection of our water supply are to be entrusted, should have jurisdiction over a complete water shed area will, I think, be generally agreed. Such an Authority should be representative of the most important interests within its district; for instance, of the landowners, of important local industries, of the water companies, and of the communities who are supplied by those companies, Such an Authority should be strong enough to be independent of local interests and local influences which might operate against the right performance of its duties; and should concern itself entirely with the supervision and protection of the water shed under its control.

If we look for a precedent of such an Authority, we find an excellent model in the Lee Conservancy Board, which is constituted in the manner which I have described.

Whatever its defects and shortcomings may have been, this Board has worked continuously and systematically during thirty years for the purification of the River Lee, and has worked with pre-eminent success.

In a paper written by Major Flower, and entitled "The River Lee up to date" (which is to be found in the library of this Institute), a very interesting description of this watershed will be found, together with a history of the River Lee Conservancy Board, and an account of the numerous pollutions to which the river used to be subjected, and of the ways in which those pollutions have been gradually and systematically abolished.

Major Flower, who for so many years has acted as Sanitary

Engineer of the Lee Conservancy Board, strongly advocates individual action as compared with action by Committee.

To quote from his excellent address on River Pollution delivered at the Leeds Congress last year :—

"In River Pollution no half measure must be adopted. What the country requires is a sound and firm Act of Parliament having compulsory and not permissive powers, entrusted to competent men to carry out, administered in each watershed by a man who by his personal influence can induce polluters to abate their nuisances, not necessarily an autocrat, but one who knows how to exercise the duty entrusted to him with judgment and firmness, governed by Conservancy Boards, to legalise the acts of such officials. I find that it pays to 'ask' for that which the Courts might 'compel.' Nothing exasperates a man more than being served with a 'notice.' Such a man generally consults his solicitor, who, in the present state of the law, usually gets his client out of his trouble, and the pollution complained of remains."

These sentiments and opinions will be appreciated by every true born Briton, and the history of the Lee Conservancy Board gives plenty of examples which illustrate the fact that individual diplomacy and tact may triumph where threats of the law, or manifestoes of a committee would almost certainly fail.

Three instances may be quoted as illustrations from the records of the River Lee :—

The first that of a town, the town of Luton, which formerly discharged its sewage into the river after treatment by a method sanctioned by the Lee Conservancy Act but obviously inadequate. This town with its 30,000 inhabitants,—to its honour be it recorded,—convinced by individual persuasion, decided to pump its sewage away from the river and distribute it over a sewage farm, the effluent from which has been shown to be innocuous to the river. This scheme, adopted after careful investigation and experiment, was carried out at a cost of over £40,000. Could such a reform have been carried out through insistence of a Committee or threats of legal action?

The second instance is that of a large riparian landowner, who was strongly opposed to the Lee Conservancy Act, and without doubt would have resented and opposed any compulsion by the Board or threats of legal action. When approached by the accredited representative of the Board, and convinced that through the conditions of his property he was contributing largely to the pollution of the river, he without hesitation decided to put a stop to this pollution, and carried out his intention at his own cost, although the expense was very considerable.

The third instance, and there are many such in this country, was a transgressor through ignorance, who when convinced of his transgression, at once repented and made more than ample compensation for the errors of the past. The town of Hatfield, with a population of 4,500, formerly discharged its sewage into dumb wells (*i.e.*, cesspits which are not watertight), in the chalk, to the detriment of the river Lee. But Lord Salisbury, at his own cost and charge, put an end to this eminently unsatisfactory state of things, and laid out an ample area as a sewage farm, where the water-carried refuse, not only of the town but the mansion is disposed of without nuisance to anyone.

These, together with many other instances of pollution removed from the very sources, the tributaries and the main river itself, as recorded in the history of the Lee, demonstrate the desirability of placing the watershed under the control of one competent authority, and of adopting the methods so long employed and strongly recommended by Major Lamorock Flower.

I have not touched upon the Thames Conservancy Board, partly because it seems a subject too large and too complicated to be dealt with in such a limited discussion as this.

It seems to be almost superfluous to be bringing forward these facts and arguments in order to prove the necessity for more effective legislation for the prevention of water pollution.

To many it must be a constant source of wonder and distress that the attempts at reforms in this direction have failed again and again. The cause, without doubt, lies chiefly in the ignorance and indifference of the people.

How is it that the people of this country have for so long tolerated with indifference the widespread pollution of its water supplies,—private and public,—with human excrement?

One would have thought that a nation which prides itself on its general common sense, cleanliness, and high sanitary instinct, would have rebelled against so revolting a custom, and that it would have spared neither effort nor expense to prevent the yearly sacrifices of thousands of victims which are the result of this pollution.

This indifference is not from want of warning, for our leading sanitarians have never ceased to proclaim the causes of our typhoid epidemics, and the means of preventing them; it is not from want of experience, for every year records its tale of sickness, death, and loss, resulting from these obvious causes; nor is it altogether from want of conviction, for throughout the country the pollution of water supply is the most commonly accredited cause of typhoid fever.

It is true that many distinguished authorities on Public

Health, many Medical Officers of Health and other Sanitary officials, private individuals, and influential associations have appealed again and again to the people and to Parliament for reforms by which this disreputable and disastrous toleration of a filthy and prevalent national habit may be abolished.

They have appealed in vain.

We cannot hope for thorough and effective legislation against water pollution until the people have been roused from this indifference; until they are made conscious of the disgusting contamination to which our water supplies are so commonly liable, are convinced of the consequent danger to which they are themselves constantly exposed, and insist upon those reforms which will afford them reasonable protection.

The indifference of the people, therefore, is the first and the greatest obstacle in the path of the necessary reforms; and the important question is—how to overcome it?

There can be no doubt that the chief cause of this indifference is ignorance;—ignorance of different kinds and degrees, but common throughout all classes. There is ignorance of the lowest degree;—ignorance of the simplest laws of Nature, ignorance of the most obvious laws of health, ignorance of the nature and causes of typhoid fever, and of the way in which it spreads from man to his neighbour or to a large community. Such ignorance can be dispelled only by persistent and systematic education; and it is for this reason that I have ventured to suggest (by proposing a resolution to this effect) that this Institute, one of whose primary objects is "to diffuse knowledge relating to Sanitary Science," should (through its Council) consider a scheme "for diffusing knowledge relating to the causes of typhoid fever and the ways of preventing it."

Without pretending to dictate in any way with regard to the details of such a scheme, it may be suggested that much might be done by encouraging education with regard to the laws of health in our elementary and other schools (so ably advocated by my friend and colleague, Dr. Kenwood) by inviting the co-operation of philanthropic associations, such as the St. John Ambulance Association and the National Health Society, and of the Fisheries Preservation Association; and by invoking the aid of the Pulpit, the Press, and the Platform.

Might not the Conference on River Pollution form a constant item in the Annual Congresses of this Institute?

There is another degree of ignorance, common probably to nearly all of us, the ignorance, that is, with regard to the history and character of the water which we purchase for daily consumption by ourselves, our families, and our households. How many are there here who could give us an accurate

account of the nature and history of the water which he purchases year by year for his household, of the character of its sources and surroundings, of its remoteness from cesspits, from deposits of excrement, of its security from pollution by leaking sewers and contaminated soil?

As parents, as householders, or in both capacities, it is our bounden duty to those under our protection, as well as to ourselves, to inquire into these matters; and, seeing that we pay well for the water which we purchase, and that there is always a risk of poisonous contamination of that water, we ought to claim the right of being able to assure ourselves that due provision is made for the protection of our water supply.

For this reason I have inserted amongst the requirements for the prevention of pollution a demand that the description, plans, &c., of any water supply should be made readily accessible to every customer of the water company, as well as to the Sanitary Authority.

If the people of this kingdom only knew what has been learnt and established with regard to the origin, course, and prevention of typhoid fever; if they only knew how common and widespread is the pollution of our water supplies, and how constant the risk of typhoid invasion through such pollution, there can be little doubt that fresh legislation would be insisted upon without delay.

In this paper I have tried to deal with the question before us as a National question. The subject of the water supply of our Metropolis is so large, so complicated, and so exceptional that I presume it is quite beyond the scope of our discussion to-night.

For brevity's sake also it has been necessary to omit several most important considerations, which ought not to be excluded in a discussion of water-borne typhoid; for instance, the pollution of private wells and small collections of water, especially in our rural districts, and the means by which such pollution may be prevented; a subject so important that it would well afford material for another separate discussion.

The same applies also to "milk-borne typhoid." It seems impossible however to mention this subject without protesting against the ludicrously inadequate protection of our milk supplies provided by the existing statutes.

The demands which I have advocated on behalf of the protection of our water supplies may seem too large, too exorbitant, too adverse to vested interests, too exacting from our water companies.

But I maintain that, if these companies are doing their duty there would be little or no extra burden laid upon them:—if they are to ensure the exclusion of excremental matter from the

water which they supply, a complete record of all parts of the waterworks from source to distribution, illustrated by maps, &c., as I have suggested, is a first necessity; constant and vigilant inspection is equally requisite; nor does it seem too great a tax to insist that the Companies shall expend as much for safeguarding the health and lives of their customers by constant inspection as a fishing association would for the protection of its trout.

That the companies should be held responsible for the consequences of pollution which has been suffered to occur through culpable negligence on their part appears to me to be as natural and as just as that Railway Companies should be responsible for accidents which have occurred to their passengers through similar neglect.

But, however great these demands may appear, they sink into utter insignificance when compared with the results which may be confidently looked for from a wholesale abolition of water pollution.

We will say nothing with regard to the æsthetic side of the question, however strongly that may appeal to us; of the rescue of our lovely streams and rivers from hideous desecration; of recreation ground restored or preserved to all that love the use of boat and oar; of the revived hope of the angler we say nothing, only because we hope, through these much-needed reforms, to attain results of far greater import.

Is it not worth while to us as a nation to make and insist on far greater sacrifices and to do the utmost within our power, if thereby we may ensure the prevention of so much death, suffering, and financial loss; if by well considered and combined action we can expel from our midst this plague which is such a constant reproach to us; the subtle disease which preys above all upon the young and active, the flower of the flock, the breadwinner of the family?

If you agree with me, as I feel assured you do, support and co-operate with those who are engaged in repelling the enemy from our gates. The protection of our water supplies is but one of our lines of defence, but it is one of the most important. It is for us to see that there is no weak point in that defence. To be effective it must be complete.

If you agree with me I trust that you will give your assent to the following resolutions which I venture to bring before you:—

Resolutions to be proposed.

That the Council of the Institute be requested to consider the possibility of organising and carrying out a scheme for

diffusing knowledge with regard to the causes of typhoid fever and the means of preventing it throughout the whole kingdom.

That the Council of the Institute be requested to consider the best means for obtaining new and effective legislation for the protection of our water supplies from pollution, whereby it shall be enacted that—

(1) All local Sanitary Authorities shall have free access to the water supplies—from source to distribution—which are distributed within their districts, whether the source and course of the water so supplied be within their district or not. That the Sanitary Authorities provide for the thorough and regular inspection of the water supplies distributed within their districts, and for the regular analysis of such water, as often as may be deemed sufficient, and that the results of such inspections and analyses shall be regularly recorded and published.

(2) That the waterworks companies shall prepare and publish records of their water supplies; such records containing a full account of every source and tributary of the water supply, and a full account of all reservoirs, conduits, filter-beds, mains, and pipes by which the water which they supply is collected, stored, or conveyed, to the houses supplied; such records also being fully illustrated by maps, plans, and sections, showing the relation of all houses, drains, sewers, cesspits, and all deposits of organic refuse in the immediate neighbourhood of any part of the water supplied by them, and that all such records, maps, plans, sections, &c., shall be freely accessible for the purposes of inspection to the sanitary authority within whose district the water is supplied, and to every customer of the waterworks company.

(3) That the Water Companies shall be required to make regular constant and thorough inspection of all parts of their waterworks—from source to distribution—with a view to preventing wilful, careless, or accidental pollution; also to make regular analyses of the water supplied by them, so often as may be considered necessary; and to make and publish reports of all such inspections and analyses.

(4) That Waterworks Companies shall be made responsible for the consequences of the pollution of water supplied by them, if such pollution could reasonably have been prevented.

(5) That wilful or careless pollution of any water supply shall be regarded and treated as a penal offence.

(6) That authorities, representative of the interests concerned, be appointed for each watershed of the Kingdom, who shall have the general care and supervision of the waters within each respective watershed; shall take prompt measures to prevent any threatened pollution, and to arrest any detected pollution

of any water; and shall be responsible for the due and effective administration of the laws respecting the protection of water within their districts.

The Chairman (Mr. Shirley Murphy) said that a letter had been received from Dr. Sims Woodhead with reference to the subject, which they might like to have read before proceeding to the discussion of the paper:—

"In regard to the points raised under the first two headings, I am certainly fully in agreement with Dr. Childs that typhoid fever is very frequently water-borne, but that in our anxiety to fix the method of spread of the disease we too frequently overlook the conditions under which foci, from which the disease may spread, are formed. If there were no foci outside the water supply this method of spread might be entirely left out of account, as the typhoid bacillus in water is at a distinct disadvantage in every way, and all the evidence, we have, goes to show that the effects of a single infection of water, especially when the dilution is—as it usually must necessarily be—great, are soon lost, and that it is only when there is constantly recurring infection that the disease continues in anything like epidemic form. All the experiments carried out up to the present time with typhoid bacilli in contaminated soil, however, indicate that the typhoid bacillus may remain alive and active in *soil* for enormously longer periods than it can remain in *water*. For this reason it is necessary that although the utmost care should be exerted as regards the examination of every water supply, still greater care should be exerted in making the examination not only of the collecting grounds but also of the ground in which pipes and mains are laid.

"It is now generally accepted that the typhoid bacillus is the *fons et origo mali* and that being the case it is evident that if we can determine the conditions necessary for the growth and multiplication of the typhoid bacillus, we have at once in hand the means by the application of which we shall be able to circumscribe or destroy its power of doing evil.

"I am quite at one with Dr. Childs that, although chemical and bacteriological analyses are exceedingly valuable as indicating the conditions under which water is being taken and in determining the nature and source of the supply, careful supervision and an intelligent examination of all suggested supplies and the elimination of any of them that by any means at our disposal are proved to be suspicious, would ultimately lead to an enormous improvement in the water supplies in the country.

"It must be remembered that at present there appears to be a kind of natural antagonism developed between local sanitary authorities and waterworks companies. This attitude may be readily understood when it is remembered that the objects of the two sets of men may be said to be diametrically opposed The sanitary authorities wishing to carry out sanitary improvements at as little cost as possible, often

interfere greatly with the collecting and distributing areas of the water-companies, whilst the sanitary authorities also naturally wish to throw the onus of keeping the water-supply pure on to the shoulders of the water-companies. These interests should not be allowed to clash and there can be no doubt that the sanitary authorities should have the right to impose certain restrictions such as those mentioned by Dr. Childs on the water-companies; but in return for this they should be compelled to assume the onus of examining the water and the water-collecting and distributing areas and determining whether such water is fit to be supplied in the areas over which they have control.

Considering, as has been pointed out by the author of the paper, that the sanitary authorities are very frequently the greatest sinners in the matter of pollution, it can scarcely be expected that under present conditions a just balance will be held by local authorities unless they are made responsible for the collecting areas, or some central authority has power given to it to advise and control wherever matters of dispute arise, and I cannot help feeling that Major Flower was right when he suggested that compulsory powers should be obtained to deal with many of these matters.

It must be remembered that many of the water companies at present in existence have to work under very great disadvantages. They are frequently in the position of having to make bricks without straw, whilst in most instances, also, they have to rely entirely upon outside and unofficial advice, often very freely tendered and not always by those best fitted to advise, for their information of the advances in bacteriological and chemical knowledge. What strikes one more than anything else in connection with this subject is that the time has now come for the formation of some central board of advisers and of appeal to which water-companies, whether public or private, or sanitary authorities, might appeal in all matters concerning improvements and alterations, and to whom also consumers might appeal in cases where they are not satisfied with the present condition of any water supply. If, to such a board, compulsory powers could in any way be given, there can be little doubt that a considerable step would be made towards the solution of what is, at present, an exceedingly important but difficult problem.

Major LAMOROCK FLOWER (London) thanked Dr. Childs for the kind way in which he had mentioned his name and the Board under which he had acted for so many years. He quite agreed with Dr. Childs in following out the principle of the water-shed as the area for jurisdiction, and was entirely opposed to the manner in which the present protection of water is carried on, as emphasised in the small water-shed, only 600 square miles, over which he had the pleasure to preside. However valuable a committee might be, he did not believe that was the way to get rid of pollution of rivers. He took over his duty in 1871, and he asked the Lee Conservancy Board to give him a free hand; it was twenty-seven years ago, and he still retained that free hand. Wherever interference had taken

place with himself in the discharge of his duties there they had failed. Luton had been mentioned as a case where individual persuasion had produced certain good results, and he was glad to say that there were other cases besides Luton in which it had also been carried out satisfactorily. He was present at the opening of the new sewage works at Luton, and had told the town of Luton that if they would only follow his lead he would protect them from that profession which was so distinguishedly represented by his old friend the town clerk, now dead. In his reply that gentleman said he had made more money professionally by following the lead that had been given than if he had fought an action out in the courts of law. There was satisfactory protection so far as Luton was concerned, simply because he had asked them to do it. Another town might be mentioned, Hertford, which at that moment polluted the river Lee as it did in 1884, and why? Because the Lee Conservancy Board took action against the town and lost. The pollution was justified by the High Court and continues to this day. He did not blame the authorities for standing to their legal position, which they had been able to win, but the day must come when the pollution of Hertford will be abolished, because the Royal Commission over which Lord Balfour of Burleigh sat, said that pollution must be abated without delay. Individual action, he thought, must be the keynote of all their work, and he was pleased to testify to his complete agreement with Dr. Childs.

Prof. J. Lane Notter (Netley) said the question was a large one and involved many interests. It was only since people had begun to use water that the necessity for dealing with the supply at the other end had been recognised. He agreed with Major Flower as to an area being under the control of an individual rather than of a committee; he had seen the advantage of this over and over again and knew the benefit derived from it. A little talk would do what a committee with all their manifestoes was unable to accomplish. Many points in the paper deserved attention, but perhaps none more so than the criticisms upon the chemical and bacteriological examination of water. Experts very often differed and the matter had to be regarded in its broad sense. He was quite certain that we would learn more from looking at the page of everyday life, at the sources of the water, at its surroundings, at its distribution very often, than we would do from the exact knowledge which the chemist or bacteriologist could give. No doubt these were useful aids, but they would not supplant that individual observation, that individual study of the subject on the spot, which could only be done by one who had the interest of the community at large at heart, and who really was in a position, as Major Flower happily was, to superintend it, and with such admirable results. He was sure the paper would lead to the subject being taken up in the broad spirit it was intended.

Dr. S. Rideal (London) remarked that the paper was interesting and a useful contribution to our knowledge of the subject. The

difficulty to his mind was how to bring about these improvements which they all agreed ought to be effected. Conflicting interests were really the stumbling block in the path of reform. In London it was a question whether the authorities higher up the water supply should be compelled to purify their sewage to such an extent that the people of London could drink the water afterwards. The question was upon whom should the expense fall, as at present the counties objected to cost of purifying the water up to the London standard. This seemed to be the crux of the matter, and then came the question as to what standard should be regarded as absolute in such cases, whether the water should be purified up to a drinking water standard or whether they should purify their sewage up to a point at which it would be harmless when discharged into the river, and would not prevent that river from being navigable and available for rowing and fishing. If they adopted the higher standard the question was who should pay for it. It seemed therefore to him a question whether after all it would not be desirable in those cases in which a river supply is practically the only available source of water supply for a community, to begin at the other end instead of attempting to purify the river up to a drinking water standard; whether it would not be better to assume that the river is polluted, and that the water is not a safe water for drinking purposes, and to aim at a purification locally in the houses and at each water tank in the town. Such a system of purification in large towns would, he felt sure, cost far less than the attempt now being made to purify the water of our big rivers up to a drinking standard. In that case the people who really required to use the water for drinking purposes would pay for the cost of its purification.

Dr. A. Newsholme (Brighton) said they were indebted to Dr. Childs for his excellent paper, within the scope of which the subject of the metropolitan water supply hardly came. But they could not have helped noticing that both in Dr. Childs' remarks and in the remarks of those who followed him the subject was dealt with almost entirely as a question of drinking water supply derived from rivers. That was an important branch of the subject, but he did not believe as a matter of fact that the greater proportion of the population of this country receive their supply from rivers, but from surface water or deep wells. The matter therefore also had to be considered from this point of view. The assumption throughout had been that polluted water was the cause of typhoid fever on a gigantic scale, but there had been some very interesting observations made by the Chairman in which he had shown very clearly that in London itself there had been minor explosions of typhoid fever occurring about a fortnight after storms in the Thames and Lee valleys, they being apparently caused by the rushing into the rivers of polluted matter and the subsequent imperfect filtration of the metropolitan water supply. Personally, he believed the relationship of cause and effect had been made out, and attention ought to be given to the subject, for the increase of typhoid fever cases had been confined to those

parts of the metropolis supplied with river water, those supplied with deep wells having escaped. So that they might have a sprinkling of cases of water-borne typhoid as well as an epidemic. In the face of such a big epidemic as that at Maidstone they were apt to forget the possibilities of danger which lurk in our midst all the time. This seemed to him the strongest possible argument for the universal control of the water supply by the municipalities, and the taking of it away from the companies. Why should London have to wait for this reform when nearly every other part of the country is obtaining the control of its own water supply? The first object of a water company was to pay a dividend, and the first object of a local authority which knows its duty was to secure that the people should not be poisoned by the water they used. Consequently it was of the utmost importance that London as well as other towns and districts should have the control of its own water supply. Then came the question of inspection inside and outside the district of supply; who was to conduct those inspections? That was the crux of the whole question. Dr. Childs and Major Flower would like to create further authorities; but he thought that this would only create further confusion. It seemed a pity to multiply authorities, there were plenty of authorities in existence ready to do it if they only had the power conferred upon them. If they did not exercise their powers then it should come within the power of the Local Government Board to intervene. He objected very much to this duty being left in the hands of the larger authorities, and worse still solely in the hands of the Local Government Board, which was a political body, almost entirely impotent, and when not impotent it was obstructive, varying between these two extremes.

Mr. J. A. WANKLYN (London) said he agreed with a great deal that had been put foward, especially that the causes of typhoid fever were very numerous, and many of them little understood. It was his belief after forty years' experience in the examination of water that with the exception of the spread of typhoid fever by private wells, there is practically no spread of typhoid fever by the water companies.

Dr. LOUIS PARKES (London) said that the paper was a very valuable one, and the resolutions Dr. Childs proposed should be brought before the Council of the Institute: therefore he would second them. The Council would consider them and perhaps see its way, subsequent to the publication of the Local Government Board report on the Maidstone epidemic, to get up a strong deputation to wait upon the Government for the purpose of impressing upon them the necessity for taking some action in regard to safeguarding public water supplies. No doubt some steps ought to be taken, but exactly what steps did not transpire from the discussion. His own idea was that as the County Councils existed all over the country they might be invested with further powers, if necessary giving them the sanitary control and powers of inspection of the water-shed areas of the county. The

medical officer or engineer of the county could assist the medical officer of health to the local authorities, and do very much what Major Flower had done in regard to the Lee Conservancy Board, in advising and assisting water authorities, whether public or private, in safeguarding their sources of supply. He quite agreed that it was inadvisable to multiply the authorities. Of course, the County Councils should have the power to go outside their own areas if necessary, though there might be some overlapping, which doubtless could be overcome. He thought if they could impress some specific scheme—not generalities—upon the Government it would be productive of what they all wished. With regard to Dr. Woodhead's letter and the point as to the bacillus not living for any length of time in water, and it being necessary to have a continuous pollution to produce an epidemic, it had struck him that though the bacillus might not live for a long time in reservoirs or rivers, it was possible when it got into the cisterns and pipes, in the dark, in a suitable temperature, and in contact with the organic matter found in the cisterns, &c., that it might exist for some time and be capable of multiplying itself, so that when once polluted water arrived in the cistern it might remain infective for a long time, although in the reservoirs and mains it might quickly disappear. He did not know whether any evidence in this direction was taken at Maidstone. With regard to the multiplication of bacteria in the ground, he thought that there was no doubt this might take place under certain circumstances. Dr. Adams had shewn how the bacillus was probably washed through the cracks in the ground and clay by the heavy rains in the district. He did not know whether these points were brought out at the enquiry, but it appeared to him that if they had been considered they would rather strengthen the view entertained by most people that this particular outbreak was due to polluted water.

Dr. Reginald Dudfield (London) rather hesitated to break up what was a very unanimous meeting. But three points occurred to him. First, while agreeing with Dr. Childs generally in his admirable paper, and admitting that the author was entitled to select his subject of water-borne typhoid, he thought that at the present day there was far too great a fixing of the attention on that one aspect of the case. He felt that he wanted to see dirty conditions got rid of, not merely in the water, but in the soil, in the houses, and in the food supplies generally. Next Dr. Childs seemed to carry his remarks as far as the filter and stopped there. The results published month by month by the Local Government Board examiners of the water supplies and water companies (which, he thought, all would accept as true) showed that the bacterial purification of the London filters was exceedingly good. But when the water left the London filters it had many vicissitudes to go through. London was riddled with defective sewers and house drains, and it was proved at Croydon that the water main acted as a sucker and sucked filth into it. They had no evidence how far this might be the case in London. Then Londoners went out of town and the autumn was

the time for typhoid fever. There were many instances of typhoid fever having been acquired outside London, and enquiries he had made gave 10 per cent. of the notifications of typhoid fever acquired in this way. In other districts the proportion might easily be higher. Then as to the inspection of sources, what would be the logical result? England was a small country, densely populated. Each town was anxious to have its own supply, and would acquire water-shed areas. Experts would not like those water-sheds to be manured, and the country would be mapped out. Then he did not see where agricultural produce was to be grown. This was of course beyond the limits of the paper, but still the point had occurred to him.

Mr. Wolf Defries (London) expressed concurrence both with Dr. Dudfield and Dr. Rideal in the view that the paper had stopped short at the distributing works, and had not contemplated the fate of the water afterwards. However much he might sympathise with Dr. Rideal's suggestion, from a considerable experience of the fate of purifying apparatuses, and the class of people who use them, he was bound to say he did not think it would answer the purpose contemplated. The effect would be to provide better for those persons who are already best provided for, and leave those persons who are most exposed to the stress of circumstances, who are most liable to catch infective disease, substantially as little protected as they are at present. This did not alter the fact, however, that it was a thoroughly good point that the water after it leaves the works required more protection than it had got. He did not think that in any part of its career it was possible to obtain for water an absolute final, definite, certain protection. They had to consider first, second, and third lines of defence, and it seemed to him that the only line of defence referred to in the paper was the first. He should be sorry to in any derogate from the importance of making good the first line of defence so far as it can be done, but at the same time the other lines of defence, the means of purification and the safeguarding of the means themselves, were equally important. As Dr. Newsholme had pointed out, those were matters which had to be considered jointly with the primary duty of protecting the water supplies, and the chain of defence must be measured by the strength of its weakest link. The term water company involved the assumption that the authorities responsible for the introduction of imperfect water were necessarily commercial bodies, trading commercial bodies who have monopolies. He thought that our recent experience by no means bore that out. At Kings Lynn it was a local authority with their eyes opened by the Local Government Board. This might be the only case at present, but it was possible there would be others. He felt very strongly that the interest of a town was a matter measured by pounds, shillings and pence. There were many instances of local authorities not regarding the health of their own towns. Could they expect one sanitary authority to send out of its own district and protect the water supply of a neighbouring town. When they recommended that further powers should be given to this class of authority they

incurred a grave risk of putting forward weapons which looked well on paper but which put into inexperienced or apathetic hands would be weapons to be turned against the cause of public health by reason of their results being so totally disproportionate to their elaboration. It was a point to be considered that the adoption of ineffective means was liable to operate ultimately against the cause sought to be promoted.

Mr. Shirley Murphy (The Chairman) said that the great difficulty underlying the whole question was that human nature is not always to be relied upon. The machinery of administration has to be designed in such a way that the frailty of human nature can be least capable of inflicting injury. He thought that there was one broad principle which ought to govern the control of water supplies to communities, and that was that they ought not to be supplied for profit. The very moment water was supplied for profit, whether it be by a company or by a sanitary authority—for he was afraid that some sanitary authorities must be definitely accused of trading in water—they were exposed to risk. Water was a necessity to the community, it ought to be supplied in fit condition for its purpose, and it ought to be supplied without profit. The moment it became a trading interest difficulties arose, of which they had so much experience at the present time. This was a point which ought to be borne in mind, and it was one which he should be very glad if it received the attention of the legislature. They were much indebted to Dr. Childs for his paper, for not only had it been interesting in itself but it had drawn forth a very interesting discussion, and he would ask them to give Dr. Childs their cordial thanks.

The compliment having been accorded with acclamation,

Dr. Childs, in reply, thanked the Chairman for his remarks. He had expected much greater opposition during the discussion: that Dr. Woodhead, for instance, would have criticised what he had said with regard to the chemical and bacteriological analysis of water. He did not underrate the value of these analyses, but wished to emphasise the necessity of thoroughly examining the surroundings and conditions of the source and course of the water supplied, in addition to making these analyses. Bacteriological analysis was certainly of great service also in gauging the efficiency of sand filtration. Much as he respected Dr. Rideal's opinions, he could not agree with him in his advocacy of domestic filtration. Domestic filtration, as a general custom, could not be relied upon. If the nation were thoroughly in earnest about the matter and insisted upon being supplied with pure water, they would no doubt obtain it. More effective legislation and more effective administration of the law were required, and the first and greatest difficulty in the way of obtaining this were the ignorance and indifference of the people. For this reason he hoped that the Council of the Sanitary Institute

would favourably consider his first proposal—"that a scheme should be organised and carried out for diffusing knowledge with regard to the causes of typhoid fever and the means of preventing it throughout the whole kingdom." He would be glad, for instance, to see a Standing Committee formed, and a Conference held, at each annual Congress, to deal with the prevention of water pollution. Dr. Newsholme had spoken of the mischief of multiplying authorities. But the formation of Conservancy Boards on the lines of the Lee Conservancy Board, which he (the speaker) advocated, did not necessarily imply the multiplication of authorities. He had brought forward the River Lee Conservancy Board only because it appeared to him to present an excellent model and to have afforded for many years an object lesson to the whole nation. Sir Francis Powell (who was prevented by indisposition from being with them), together with others, was at that very time engaged in promoting a Rivers Pollution Prevention Bill, one of the chief objects of which was to provide for the promotion of Conjoint Committees and Rivers Boards deputed by local authorities to take under control the streams, rivers, &c., within their respective watershed areas. The measures which he regarded as the most important for the prevention of convection of typhoid fever through public water supplies were—the diffusion of knowledge and the exciting of interest with regard to this question amongst all classes of the people; new legislation which should enforce constant and systematic supervision and inspection of the water supplies from source to distribution, and should secure effective administration of the law; whilst Waterwork Companies, or authorities in possession of the water supplies, should be held responsible for the results of preventable pollution. He hoped that the resolutions which he had proposed would be brought before the Council; for, though they might contain some impracticable suggestions, it would be for the Council to deal with them as they thought fit.

The resolutions were seconded by Dr. Louis Parkes, agreed to *nem. con.*, and stood referred to the Council.

NOTE.—A Standing Committee on River Pollution has been appointed by the Council, and these resolutions are under its consideration.

THE DESIRABILITY OF MAKING WATERSHED AREAS AND SANITARY DISTRICTS COTERMINOUS.

By R. E. Middleton, M.Inst.C.E., M.Inst.M.E.

(Fellow.)

Read at a Sessional Meeting held on April 6th, 1898.

As was remarked by Major Flower in his address to the Leeds Congress 1897, the division of the Country into watershed areas, for purposes of water supply and drainage, which areas shall be made coterminous with sanitary districts, appears to be very desirable.

The writer pointed out in his paper on the "Pollution of Rivers from an Engineer's point of view," read at the same congress, that rivers and streams have, from the earliest times, been put to two different and antagonistic uses, they have been considered to form the natural source of supply for water to be used for drinking, culinary and ablutionary purposes and at the same time to be receptacles for all animal, vegetable and mineral refuse. It has even been maintained in quite recent years that the latter is the natural and primary duty of every river and stream.

It is scarcely necessary to point out to a Society of Sanitarians that the first use of a river is to provide water for animal life. Secondly it may provide power for grinding corn, for the weaving of fabrics, and for such other purposes as may be beneficial to the riparian inhabitants. Thirdly it may be used for carrying the persons and property of those who live near it, and the necessaries of life from point to point. Lastly and not until the other requirements have been satisfied, it may be used, in a manner which shall not defeat its primary obligations, for the removal of refuse matter.

Needless to say the requirements of a crowded population and of an advancing civilisation have materially altered the second and third items of legitimate use, mills are in many cases built and worked, not for the supply of the necessaries of life to the inhabitants in its immediate neighbourhood, but for the production of goods to be supplied, perhaps to distant countries, the

only benefit accruing to the people of the district being found in an increased demand for labour and consequent circulation of money, the riches produced being diffused over a large area.

It frequently happens that manufactories which originally depended on water for their motive power, have found the supply inadequate and unreliable on account of its intermittent character and resort has been had to steam, whereby a portion of the water has been taken from the river and has been diffused into the atmosphere as vapour, also the use of the water has not been limited to power, but large quantities have been employed for the cleansing of foul rags or other articles for mixing with materials used in the processes of manufacture and for the removal of chemicals from partially manufactured goods.

Advancing civilisation, especially in respect of rapidity and facility of transport, has both enabled and obliged the manufacturer to locate his business in a position where the supply of raw material with which he deals can be obtained most easily and therefore most cheaply, where wages are low and where motive power is cheap.

As the land of the country will no longer supply sufficient corn for the consumption of the population, and as each year brings a larger and larger supply of cereals to our shores from foreign countries, flour milling is no longer so profitable a business, when conducted under the old conditions on small rivers, as it was in former times; larger mills and more elaborate machinery are now required for the production of the fine and white flour which is now used almost universally, the old fashioned flour or wind-mill is becoming obsolete, and is being replaced by modern mills driven by steam power and situated near a sea-port.

On the other hand processes of manufacture, which require large quantities of water for cleansing purposes, are increasing, and the mill which, in the old days, provided food for its district, has become a source of pollution in itself, and a centre of pollution on account of the population which has grown up around it and which is dependent on it.

In every direction we find the tendency to pollute is on the increase, at the same time that the demand for a supply of pure water is likewise increasing, while the area from which a supply can safely be drawn is diminishing and many rivers have become impossible as sources of water supply, in all cases on account of the amount of trade refuse which has been passed into them.

In the mining districts the banks of the rivers and streams become tip heaps for ashes and scoria, often containing poisonous ingredients, all sorts of refuse are thrown into them, they stink and are corrupt, but filthy as they are they are not so offensive

as are the waters which are used for washing rags, or woollen goods, for cleansing skins, or the waters that are near large breweries.

Undoubtedly the pollution which is most dangerous to man is that produced by man himself. The untreated excreta of the human being are at all times a source of danger, but when they proceed from a diseased human being they may carry with them the germs of death to many fellow creatures, and with the increase of population comes increasing difficulty and increasing costliness in dealing with the refuse, animal, vegetable and mineral, which results from human aggregation.

It seems to be doubtful if any danger is to be feared as resulting from the droppings of cattle when living in the open, and even if they are to some extent dangerous they are necessarily limited in quantity, for cattle cannot live in an area which will not easily disinfect all the manure which they produce.

Probably the artificial manures, if one may thus designate guano and fish in a putrid condition, are much more to be feared than any natural manures; the fish are, however, in themselves, so offensive to the sense of smell that they are seldom used except for very high cultivation, such as hop gardens.

An endeavour has been made to point out in a brief but effective manner the causes which are producing an increased use of water for the supply of steam to engines, for cooling and other purposes in iron and steel works, for the cleansing and manufacture of the materials used in paper-making, fell-mongering, woollen and linen manufacture, brewing, in chemical works, and in a thousand other ways, much of such water being diffused into the atmosphere as vapour, while still more is so befouled as to be unfit for drinking, culinary or even for washing purposes.

In another direction the available water supply is also becoming more limited on account of the amount of land which is occupied by towns, villages and manufacturing centres, while both the increase in population, the demands of a higher civilisation and the greater requirements for steam and similar uses, all call for a greater supply and a more liberal use of water.

Consequent on the increase in the size of our large towns the demand for water has led to an upsetting of all preconceived ideas as to the sources from which supplies should be obtained. Manchester obtains a supply, not from its own district but from Cumberland, Liverpool from Vyrnwy, Birmingham from the Elan Valley, and the London County Council would have us look to the Valleys of the Usk and Wye for our supply of water, and there does not at the present time seem to be any efficient conservation of the sources of supply for the use of those who

are the natural heirs to it, namely those who are the first to receive it from the atmosphere and at whose feet it is running, either above ground in the form of streams, rivers, and lakes, or below ground in tiny rills. Every town or village situated on the banks of the river or one of its tributaries has a vested interest in the maintenance of the purity of the water which flows towards it. Even if it does not obtain its water supply from the river or stream, still the fouling of the stream or river is an injury to the place, as causing a nuisance palpable to the sight or smell. At the same time, the same population desires to discharge its refuse into the same stream and to become a nuisance to its neighbour lower down on the course of the river.

It would appear on the face of it that the village situated nearest to the source of the river would have the best of it, for its inhabitants would be able to drink pure water while they would befoul what passed them by, and the population of places lower down on the course of the stream would each get a worse sample than the last and would pass it on in a still worse condition than that in which it came to them. Natural causes, the principal of which are, dilution by increase in the volume of the river, oxidation by air and light, the action of vegetation and sedimentation, tend to counteract the influences referred to, and unless the pollution is excessive in quantity the water becomes purer in the lower reaches of the river rather than the reverse; and many streams which are decidedly impure near their sources are purified before the water arrives at the lower reaches of the river.

The protection afforded to the consumer by the natural processes indicated above are not sufficient, unless they are supplemented by the power of an authority strong enough to curb the tendency of the human animal to get rid of the refuse which he creates, either as manufacturer or as an individual, with the smallest amount of trouble and at the minimum of cost. The disposal of sewage matter was, until quite recently, a subject not to be mentioned to ears polite, the matter was to be hidden away anyhow, so long as it was out of sight; so it was turned into cesspits, the positions of which were often forgotten, or into rivers, to be a nuisance to somebody else. Suddenly, sanitary science became rather the fashion than otherwise, and everybody talked of drains, with the usual result that much was done in a hurry which would have been better done if it had been longer thought over. Most large towns which can afford to spend money pretty freely have made efforts, at any rate, with but moderate success, to get rid of their sewage decently, and not to be greater nuisances to their neighbours than they could reasonably help, but the sewage disposal works

of many small towns and villages are practically useless, because the inhabitants have not the money to keep the works for which they have paid, in order. In still other cases, sewage disposal works are conspicuous by their absence.

The selfish policy of turning all refuse into the nearest stream led to greater and still greater pollution of the water supply as time went on, and population and manufactures increased; the natural course of procedure which puts the provision of a pure and sufficient supply of water first and the disposal of sewage second was reversed, and the position became intolerable; moreover, the earlier efforts of legislation were directed to the provision of sewage disposal, while omitting to require that this necessary stipulation should be preceded by an ample supply of water.

Subsequent legislation has inclined to leave the cart before the horse and to subordinate any question of water supply to that of sewage disposal, making the latter compulsory, while the former is to a large extent permissive.

Consequent on this inversion of obligations the Rivers Pollution Act of 1876 is exceedingly tender in dealing with vested interests in sewers and in the pollution of streams, and experience has shown that it is entirely insufficient to curtail the increasing tendency to pollute, notwithstanding the precautions which have undoubtedly been taken in many cases to prevent it. Later Acts have not, except as regards special localities, provided any adequate cure for the evil and then only within the last few years and in the face of the most convincing evidence and in cases of absolute necessity.

Considering the constitution of the authorities which have to administer the Acts dealing with the provision of water supplies, with the disposal of refuse and the pollution of rivers, it is scarcely to be expected that the result should be otherwise than it is. It has been easier for the authority to get water from some other source, however limited its area, however doubtful its ultimate purity, than to face the difficulties of dealing efficiently with the sewage which the same authority must get rid of. All authorities have had conflicting interests to consider when dealing with river pollution, and in all cases the preservation of the river in its pristine purity has been subordinated to the requirements of mill owners, for power purposes, of canals, for purposes of navigation, and of towns and villages desirous of getting rid of their refuse in the most summary manner and at the least possible cost, without consideration of any habitations placed below them on the course of the stream.

In this manner enormous drainage areas are becoming useless

for purposes of water supply, and large towns are compelled to tap distant and at present unused and uncontaminated sources of supply, though at great cost, and are rapidly taking from unoccupied districts the water which at some time may be wanted for the inhabitants themselves. The future centres of the industries of the country cannot be predicted with any certainty. Already within the memory of man great cities have sprung into existence where formerly were only villages or desolation.

It seems reasonable that each district should supply its own needs, both in respect of water supply and sewage disposal, but this cannot be done unless water supply, a pure water supply, be put first and sewage disposal be subordinated to it by rigorously enforcing the obligations consequent on the aggregation of large bodies of men in centres of industry.

It is scarcely to be expected that the authority which desires to discharge the refuse of its district into the stream, (and as it draws its water supply from a point higher up does not injure itself,) should be urgent in the prevention of the pollution of the river for the benefit of towns situated below it on its course and in which it has no interest.

It frequently happens that the difficulties in dealing with the sewage of a particular district are enormous, while the question of disposal would become quite simple if compulsory amalgamation were possible.

As has been very ably pointed out by Mr. Malcolm Paterson, M.Inst.C.E., in his pamphlet on "Compensation Discharge in the Rivers and Streams of the West Riding of Yorkshire," the system of compensation in water generally adopted is not by any means universally advantageous, even to those for whom it is provided, while it is destructive of the purity of the river. Mills which only work by day desire to have compensation water delivered to them during the day only, so that they may get the utmost advantages from it, but, as the water is delivered from the compensation reservoir which is situated near or at the head of the stream, the mill nearest the reservoir is the only one which gets the full benefit, while those which are situated further from the reservoir must either work abnormal hours, standing idle in the morning, or they must have sufficient reservoir capacity of their own to conserve the compensation water received during the night and use it in the morning, up to such time as the new supply from the compensation reservoir reaches them. Take the case of a mill situated twenty-four miles below the reservoir, the stream from which travels at three miles an hour and begins to flow at 6 a.m. The new supply does not reach the mill until 2 o'clock in the afternoon,

and eight hours' supply must be stored at the mill if the miller is to get the full benefit of the supply.

During the night, at points near the reservoir, the stream is probably nearly dry, and any sewage passed into it must, when added to the decaying vegetation consequent on an intermittent flow, cause a nuisance. At points lower down the river this state of things exists during part of the day as well as during part of the night, and becomes even more objectionable.

Enough has, it is thought, been said to show that if areas of water supply are to be efficiently safe-guarded, if rivers are to be preserved from pollution, if the mill-owners are to obtain the utmost benefit of the power at their disposal—but without injury to the general interests of the population,—and if the navigation, if there be any, is to be maintained, the present system of divided authority should be abandoned, and a combined and general policy should be substituted for it.

At present every authority is in conflict with its neighbour, conflict in interest if not in fact, and litigation and disagreement are too frequently the result.

There are, it is believed, cases where districts have benefitted greatly by the adoption of combined systems of drainage, as for instance in the case of the Rhondda Valley and the Pontypridd combined drainage. Here, instead of each district providing its own sewage farm, a difficult and somewhat dangerous proceeding in a valley of but limited area, the sewage of the towns in the Valley of the Rhondda, and in the Valley of the Taff from Aberdare to Cardiff, is carried in iron pipes down the valley of the river Taff, and is discharged into the Bristol Channel above the town of Cardiff. This work was, however, carried out entirely in one county, and it may not unreasonably be supposed that unless there had been a County Council having an equal interest in the whole drainage area of the Taff, the District Council of Ystrad-y-fodwyg, the Urban Sanitary Authority of Pontypridd, and the other parties interested in the disposal of the sewage might have been endeavouring to work each their own little sewage farm, to the discomfort of their neighbours, or might have been disputing between themselves without making any progress.

The three Ridings of Yorkshire, being of such large area, are intersected by considerable rivers which flow for the whole or nearly the whole of their courses through one county only, and here again, as might be expected, we find the County Councils taking considerable interest in the rivers which are their own undivided property, an interest which appears to have secured to the general public, to judge from the reports contained in Mr. Paterson's pamphlet, considerable advantages.

Most of our larger rivers, on the other hand, serve as boundaries or divisions between counties. For instance, the watershed of the Thames extends over 15 counties or parts of counties in which some 2,600 authorities, County, Borough, District and Parish Councils hold sway. The whole of these do not have jurisdiction within the watershed, but if the number given above be reduced by 20 per cent., or to 2,080, this figure will probably represent the number of authorities within the drainage area of the Thames.

The watershed of the Severn affects 12 counties and some 1,316 Councils.

The Cambridgeshire Ouse touches 8 counties and some 1,200 Councils.

There is no necessity for carrying the calculation further, but from the figures which have been given some idea may be formed of the conflicting interests existing in any watershed area.

A further consideration which appears to point in the same direction, namely, to the necessity for having some authority responsible for watershed areas, is that of floods. There are many districts in England which are periodically flooded with very disastrous results. While the floods last and immediately afterwards, there is great talk of what could, should and must be done, but it ends in talk, because the interests are so conflicting that before anything can be decided on, the matter has become ancient history, and the public mind has to be stirred up again by another flood, and still nothing results unless there is an authority with sufficient power and possessed of sufficient funds to enable it to deal with the question without directly touching the pockets of the ratepayers.

As has been pointed out, the Rivers Pollution Act (1876) does not provide powers of sufficient stringency to enable the pollution of rivers to be dealt with efficiently, and necessity has obliged certain existing authorities to apply for an extension of their powers, as in the case of the Mersey and Irwell Acts of 1892, and the Thames Conservancy Act of 1894, but these acts are purely local and it seems desirable that they should be made general and that an authority, in some respects similar to the Thames Conservancy Board, but with more expanded powers as regards the raising of funds, should have charge of each of the principal rivers in the country.

The Thames Conservancy Board before 1894 had only power over the tributaries of the Thames for ten miles from their junction with the main stream, and they could only deal with pollutions under the general acts, the operation of which was found to be tedious and ineffectual. They have, by the act of 1894, authority over the whole of the water shed, and they can

enforce their powers much more effectually than under the general law, by means of the following clauses:—

93. If any person does any of the following things, namely:

(1) Opens into the Thames or into any tributary any sewer drain pipe or channel whereby sewage or any other offensive or injurious matter whether solid or fluid shall or is likely to flow or pass into the Thames or into such tributary;

(2) Wilfully causes or without lawful excuse (the proof whereof shall lie upon him) suffers any sewage or matter aforesaid to flow or pass into the Thames or into any tributary down or through any sewer drain pipe or channel not at the passing of this Act lawfully used for that purpose;

he shall for every such offence be liable to a penalty not exceeding one hundred pounds, and to a daily penalty not exceeding fifty pounds.

94. (1) Whenever any sewage or matter aforesaid is caused or suffered to flow or pass into the Thames or into any tributary then, and in every such case, even though such sewage or matter aforesaid had been lawfully so caused or suffered to flow or pass before the passing of this Act, the Conservators shall give notice in writing to the person causing or suffering the same so to flow or pass requiring him within a time to be specified in such notice, but not being less than three months to discontinue such flow or passage.

(2) Provided that the Conservators may if they think fit at any time, and from time to time extend the time specified in such notice by another notice in writing.

(3) And provided that if any person to whom any such notice is given thinks himself aggrieved by reason of the time allowed either by the original or by any subsequent notice not being sufficient, he may not later than one month before the expiration of the time so allowed by writing delivered to the secretary demand an extension of such time, and in case the Conservators refuse to comply with such demand, the question of such extension shall be referred to an arbitrator appointed by agreement or failing agreement by the Board of Trade on the application of either party.

(4) Any person to whom any notice is under this section given by the Conservators shall notwithstanding anything in any other Act within the time allowed by such notice subject to any extension of such time as in this section provided, discontinue the flow or passage of the sewage or matter to which the notice refers, and in default of so doing shall be guilty of a misdemeanour and be liable on summary conviction thereof or on conviction thereof on indictment to a penalty not exceeding

one hundred pounds, and to a daily penalty not exceeding fifty pounds.

(5) Provided that notwithstanding anything in this Act or in any Act incorporated therewith any proceeding in respect of such a misdemeanour may be removed by certiorari into the High Court.

The same authority has also, quite recently, given considerable attention to the prevention of flooding.

In what manner the watersheds should be mapped out, whether the existing boundaries of Counties, Sanitary Unions, and Parishes should be adhered to, or there should be a general re-arrangement of these artificial divisions, is too large a subject to be dealt with in a paper of this character, time will not permit of the full consideration of so difficult a question.

The constitution of the proposed authority is also a matter of great complexity, especially as regards the method of raising the funds to be placed at their disposal, but it may be said that the body should represent every class and interest, and that its duties should consist in the conservation of the river, its banks, and navigation, if any, in the maintenance of its purity including that of its tributaries, in the encouragement of combination and efficiency in sewage disposal and in the prevention of floods.

The writer has endeavoured to lay before his hearers a question which he considers to be of considerable importance but which contains the elements of much complexity, and he trusts that the members of the Institute will be able to throw more light on the subject.

Mr. Baldwin Latham (London) said he thoroughly agreed with all that Mr. Middleton had said in his most interesting and instructive paper. The question of controlling watershed areas, especially with regard to the purity of the water supplies of the people, was one of paramount importance. Every day one was brought into contact with the fearful consequences that arise from the pollution of drinking water, and indeed, he began to think there was no question from a sanitary point of view which is of more importance than that of the water supplies of this country. When he said water supplies, he did not mean to confine himself simply to the surface streams, but to direct attention to a greater extent to those underground streams, which, being out of sight were often out of mind, the consequence being that they were polluted to a frightful extent in the immediate vicinity of the places from which the water supplies are drawn. In fact, it appeared that nearly all the epidemics of typhoid which have

occurred in this country, with slight exceptions, have been traced to these underground sources of supply. These had been polluted and had never seen the light of day, which no doubt to a very considerable extent tends to destroy the germinal matter—so fruitful a source of disease. How this matter was to be dealt with was certainly a very large question. Sanitary authorities themselves and water authorities did not seem to appreciate the importance of securing a pure water supply. Only last year a Bill was actually introduced into Parliament for making a reservoir in a small town in Sussex, where the overflow of the cesspools passed into the stream above the site of the proposed reservoir, and although that fact was pointed out to the Committee, the Bill passed. A fortnight previously a Bill was brought before the Committee of the House of Commons for the establishment of a gas works at Margate, and a most extraordinary position was selected for this gas works—in close contiguity with the aqueducts of the principal water supply of the town, which were only from 60 to 70 ft. below the surface of the site where the gas works were to be erected; yet that Bill was passed. When our legislators seemed to so little understand these questions of the importance of the purity of a water supply, and the great danger which is likely to arise from pollution, either in the distribution of the supply or the injurious properties which may be imported at its source, they could not be surprised that there were so many small communities throughout the country which did not regard the question of the water supply from any favourable point of view. They looked upon engineers who advised them that the purity of a water supply was a paramount necessity as having a crotchet, and very often said, "Well, the supply was good enough for our fathers, surely it is good enough for us." That was the answer given to any question as to the pollution of wells which exist pretty well in all the villages and towns of this country. It was, however, a great question, and they were indebted to Mr. Middleton for having brought the matter under their notice so clearly and concisely. Of course, some watershed areas were very large, like that of the Thames, others were of comparatively small area. Wherever he had anything to do with the formation of districts, he had always drawn the boundary at a watershed line: but where watershed areas passed through two or more counties they were met with great difficulties. For they were told under recent Acts it was almost impossible to take part of a district which belongs to one county and put it under the jurisdiction of a sanitary authority which principally governs in another county. That, however, had been done recently in a case where a district had been taken out of one county and put into another, and he did not see that what had been done in that small way could not be done to a very large extent throughout the country. There was no reason whatever why they should confine themselves to the present arbitary boundaries. A watershed area formed a very good natural boundary, certainly for drainage purposes. The difficult question was in regard to the large areas—an authority to pass over nearly 6,000 square miles in the Thames area would be a sort of legislative body in its

government of such a large part of the country. But there was no doubt the principles of watershed areas should be kept in view in the formation of all new districts, and not so much as had been the old boundaries of parishes, which were not properly defined, or served any useful purpose in regard to the engineering work to be carried out within the district they made. It was therefore a question which needed full investigation.

Major LAMOROCK FLOWER (London) observed that he was very much obliged to Mr. Middleton for having brought forward this old idea of his of treating the watershed area as the proper boundary for a sanitary district, and he was equally glad that Mr. Baldwin Latham had drawn attention to the absolute absence of control over subterranean supplies. He contended that no Conservancy Board is complete which has not control over the subterranean water. At the present moment there was no Conservancy Board, nor was there any authority beyond the Common Law which had any power to prevent the pollution of subterranean water. With regard to the division of the country into watershed areas, it was no doubt surrounded by a vast amount of difficulty, but a Vice-President of the Institute, Sir Francis Powell, had introduced into his Rivers' Pollution Bill of this year a clause which provided for committees to manage this very question—committees to be formed out of the existing County Councils. It had been said that if the watershed area was made the boundary of jurisdiction it would create a new authority, but he contended that no new authority was necessary at all. It was simply a combination of certain portions of the existing authorities for definite purposes, and therefore he thought the question of dividing the country into watershed areas for the purpose of preventing pollution of water was an exceedingly simple one, and only required to be thoroughly thought out by people who know what they are about to be carried into effect. He did not allow the word "impossible" to be in his vocabulary, for nothing in reason was impossible, and he did not see why this idea could not be carried out thoroughly and entirely. He believed that the Chairman, with his large knowledge and valuable experience, would be able to support the idea so ably brought forward by Mr. Middleton.

Dr. A. HAVILAND (Farnborough) agreed that they were indebted to Mr. Middleton for having brought forward this subject in the able way he had done. The Chairman might remember that more than twenty-seven years ago, when he (the speaker) first commenced his investigations with regard to the geographical distribution of disease in England, he had made the remark in his first work that a natural system should be adopted instead of the artificial one which now exists and defaces our maps of registration districts. There could be no doubt that unless the different areas occupied by the catchment basins of the different rivers and their tributaries be under control, and so managed as to be capable of doing good instead of harm as at present, statistical accuracy was impossible, because there were con-

flicting interests in one registration district. If a natural system were adopted they would know exactly how to apportion their statistics, and would be able to see what watershed areas ought to bear the burden of disease that their polluted waters engendered. In fact, it was the only scientific method of using the statistics to anything like good purpose. Those who had followed the reports of the Commissioners appointed to investigate into the pollutions of rivers would remember the excellent map of the Thames basin which the Chairman (Mr. Symons) brought forward in his evidence. Lately he had had occasion to compare that map with its natural boundaries of the water partings with the boundaries of the registration districts, and if they were to see how thoroughly opposed to anything like reason those registration district boundaries were, they would be at once convinced of the abnormity of the whole affair, and wonder how in this nineteenth century such a state of things could be permitted to exist. All catchment basins where floods are known to occur should certainly be under one authority that would be able to consider the best means to prevent those floods. Then, too, unless they had these natural boundaries it was impossible to show how certain areas conduced to certain climatic conditions, and those climatic conditions to certain diseases. Therefore from a medical and geographical point of view he certainly upheld the suggestion that the natural boundaries should be resorted to instead of the artificial boundaries. In France they had a much more natural system: they took the boundaries formed by the rivers for the most part and named the Departments after the rivers. The Isle of Man was divided into certain sheddings which comprised certain parishes—about three or four in each; shedding means water parting, and those sheddings were marked out by the original inhabitants of the Isle of Man according to the catchment basins of the different rivers. It was remarkable how easy statistics were made for that island compared with what they are for England. As a student of medical geography, he could say that his experience from the very first in 1868 led him to conclude that we shall not arrive at anything like what we want to arrive at—scientific fact—unless we had a natural system of boundaries.

The CHAIRMAN (Mr. G. J. Symons) pointed out that the delivery of compensation water had been fought a great deal, as to whether it should be sent down during working hours or whether it should be sent in a continuous flow. It seemed to him that it did not matter much what was put into an Act of Parliament, because all depended upon how big the lodge is at the top mill on the stream. If the top miller had storage for twenty-four hours' supply he could just please himself, he was master of the situation; and half a dozen Acts of Parliament could not prevent him. The County Councils, especially the Yorkshire Council, had taken a great interest in the matter and he was not saying one word against them. All wished that to be done which is best, but it seemed to him that the occupier of the top mill was monarch of the situation. Then there was the question of floods which had so many conflicting points. The

ordinary sanitarian and the ordinary Britisher had a great idea that a flood is a nuisance, and a thing that ought to be avoided. In a great many instances farmers rather enjoyed them than otherwise, and instead of getting the sympathy of farmers in their attempts to prevent them they got the other thing. He thoroughly agreed with Mr. Latham in his remarks about the pollution of underground water, but he was surprised to hear him say that he thought that all the principal epidemics of typhoid were traceable to underground water. His own impression was that a good many of them were due to milk. In his own neighbourhood there was one such case, and he had heard of many instances arising in the same way. As to the rectification of county boundaries he was rather amused at one thing. Mr. Middleton had brought the question forward, Major Flower claimed to being its father, and somebody else had suggested Mr. Haviland, while in former times it was an idea which he (the chairman) had. So it must be right as they had all chosen it. But the question was, how was it going to be carried out? One of the disadvantages of living in an old country like England and Wales, was that things were crystallised for so many years, before watersheds were thought about. He did not know how their ancestors selected the county boundaries, but water partings had next to nothing to do with it. He did not attach serious weight to the difficulty of dealing with large areas, like the Thames and some of the other rivers, say, the Severn, because he could see no reason why they should not be cut up into subsidiary ones, and then be perfectly manageable. The difficulty was their being in a very old country where it was difficult to move. There was such a number of vested interests in the way. Mr. Latham described one bit of good work in which a part of a county was chopped off and transplanted into another, and probably hardly anybody knew anything about it till it was done. In Scotland he was glad to say the same process was going on. The Scotch counties were formerly distributed in a way that made them very worrying to a school boy, and now nearly all those detached portions were being transferred by some Act of Parliament, and gradually absorbed by the counties in which they were situated. Like everyone else he had thoroughly enjoyed Mr. Middleton's paper and did not know that he had any criticism to answer, for there had been nothing but praise.

Mr. Middleton, replying to some of the points raised, said he was obliged for the way the paper had been received. He did not pretend to be one of the fathers of the idea at all, for he thought it was older than he was, but it was one of the old things which was none the worse for a little keeping—which must be impressed upon people over and over again. As the Chairman had said, this was an old country and required a good deal of stirring up to get alterations, especially in matters of sentiment. Up to recently, the boundaries between counties had been questions affected by sentiment—the people of Suffolk looked upon a Hampshire man as a foreigner who did not belong to the same country at all, and there were parts in

the north where a Londoner would not understand what the people were saying. But steam locomotion had largely changed that, the rapid travel of to-day was producing a still more rapid change in the country at large. Sentiment was largely dying out, though there was a sort of attempt to maintain it in the territorial regiments, but he did not think that had been very successful so far. As time went on it would be more easy than it had been in the past to get people to see that the boundaries between counties had in some cases been mere matters of sentiment, and that a great many of them could be improved very much, not only with advantage to the inhabitants themselves, but with still greater advantages from a sanitary point of view. There could be no question that the present divisions were injurious to many sanitary schemes and water supplies. It was often impossible to carry out a good scheme to prevent the pollution of water, because one of the parishes thought it was not the right thing to do, or sewage had to be discharged from one parish into another, where there was opposition. With regard to the size of the area, they now had the Thames Conservancy which had been given a certain amount of power over the whole of the watershed area of the Thames, which covered some 6,000 square miles. He did not say that the power which was put into the hands of the Thames Conservancy was a sufficient power, though it was considerable, and would have a great influence on the future of the Thames basin. One of the greatest difficulties, both in regard to the Thames Conservancy and any other Conservancy or Council for the conservation of the watershed of any river, was the question of funds. The Thames Conservancy were fortunately able to get a considerable amount from the London Water Companies, and a great deal of their work which was done for the benefit of London in the way of keeping the river pure for the supply of that city, was done at the cost of the water companies. But in most other places there was no fund available for the use of the Conservators of the river, and the rate-payers strongly objected to be rated directly for any such purpose. Those below said they were only flooded every now and then, and that it was not worth while; those higher up were not flooded at all, and did not think they were the ones to pay for the benefit of those lower down. The only way out of the difficulty was for the whole district to pay and the rate would be so infinitesimal that it would be scarcely calculable, nobody would feel it at all. Some means of that kind would have to be found for providing sufficient funds for preserving rivers from pollution, and also in regard to the almost equally important question of flooding. Up to lately the Thames had suffered in some cases greatly from floods. Not many years ago Taunton suffered from a serious flood, which was all the worse because timber happened to be stored beside the river and stuck in the bridge, with the result that the lower part of the town was flooded to a considerable depth. Taunton was then going to do many grand things, but they eventually did nothing. In other parts identical cases could be quoted, and he supposed these periodical floodings would continue until they got some such Board

as he had mentioned. It was true that farmers on the banks of the rivers liked their land occasionally flooded, but not to any great depth, for they did not care to have their fences washed away or anything of that kind. But if it was a flood which passed two or three inches over the land and left a sediment behind, they did not mind. This, of course, could not always be provided for. If they were approached immediately after a flood of 5 or 6 ft. they would be quite ready to pay for their prevention. Apart from that, the farmers were not the people to be considered, because it was not the farmers only who suffered from floods but the people in the towns and villages, sometimes seriously, both in pocket and comfort. The difficulties in the way of providing a proper authority were very great. He did not think an amalgamation of the Councils for such an area as the Thames would be satisfactory, for it would simply mean a shifting of responsibility and liability, the same people would be concerned, who, if they met at separated Councils would only fight still more. He did not think that would be a good and final representation, but what would be the best representation he was not prepared to say at the present moment.

REVIEWS OF BOOKS.

HOUSE DRAINAGE.*

The author has produced a valuable and complete manual on not only the design and construction of House Drainage, but what is scarcely of less importance, the disposal of the sewage of Isolated Houses, and he further gives extracts from the Public Health Acts, Metropolitan Management Acts, and Model Hygienic Laws relating to House Drainage; and the work will be found of considerable use to property owners and leaseholders, as well as an *aide mémoire* to Sanitary Inspectors and members of Sanitary Authorities.

Commencing with a sound introductory article on principles, and setting forth useful information, he proceeds in chapter I. to deal with Sanitary Surveys, then follows a chapter on Defective Drainage, with a number of illustrations. Several chapters containing useful Tables follow, chiefly dealing with requirements, planning, and details of pipes and junctions. The Ventilation of Drains is then gone into, the chapter being fully illustrated.

The Setting-out and Construction of Drains are dealt with in chapters X., XI., and XII., the many illustrations therein are well drawn. Chapter XII. deals with the important subject of the Disconnection of Waste Pipes and Gully Traps.

The Flushing of Drains follows. The author in chapter XIV. goes farther than the "drain," dealing with details which apply to the "sewer." Some excellent illustrations are in this chapter.

Perhaps the more important part of the work to the general public follows—"The Disposal of Sewage from Isolated Houses." Chapter XV. requires careful perusal to arrive at its undoubted value. The Author sets out the different Processes of Purification: Land, Chemical Precipitation, and Filtration, and deals with the latest methods, the "Septic Tank," and the "Bacteria Filter." This chapter is well illustrated, and contains a useful summary of experiments.

The remaining chapters are devoted to Legislation, and are well worthy of careful perusal.

One cannot close the work without a word of praise to the Author for one of the most painstaking and complete manuals which has been produced on an important subject. "House Drainage" should find a place in every Library a portion of which is devoted to Sanitation. The illustrations are especially good, and the whole subject is admirably condensed.

L. F.

* By W. Spinks, Assoc.M.Inst.C.E. Biggs & Co., 139 & 140, Salisbury Court, Fleet Street, London, E.C. 306 pp., demy 8vo. Illustrated. Price 5s. November, 1897.

EPIDEMIC DIPHTHERIA.

A Research on the Origin and Spread of the Disease from an International Standpoint.*

Dr. Newsholme's work is the result of an extensive and valuable series of researches into the conditions of origin and spread of epidemic diphtheria. An immense mass of facts is here collected and condensed into a form which makes it possible to comprehend at a glance the history of the prevalence of fatal diphtheria, during the latter part of the present century, in every country and important city which possesses statistical returns. The amount of work entailed upon the author in the production of this volume must have been very great, and we are not surprised to find that Dr. Newsholme speaks of the complexity of detail with which he has had to deal as being sometimes "almost overwhelming." In proportion to the advantage reaped by students of the phenomena of epidemic disease from full and accurate compilations such as those to be found in the present work, should be our gratitude to investigators who, like Dr. Newsholme, are sufficiently courageous and persevering to undertake and carry through the task of sorting out, arranging, and comparing the materials contained in the wealth of statistical returns which are now being accumulated in all parts of the civilised world. These returns, though invaluable as the raw material of scientific research, require such treatment as they here receive before being available for general purposes of study.

In view of the prejudice that exists in some quarters against the use of statistical methods, and the rather wide-spread feeling of suspicion with which results founded on those methods are apt to be received, it may not be amiss to point out that in dealing with this as with other kinds of evidence there is a right course to be pursued as well as a wrong one to be avoided. If anyone betakes himself to statistics with the primary object of obtaining support for a preconceived opinion, he is not unlikely to find what he wants; hence the well-known dictum that "anything can be proved by statistics." If on the other hand anyone will candidly examine statistical data with an open mind, and with a due regard for the various limitations and possible sources of error which belong to the circumstances of each case, making use also of those safeguards which both reason and experience have shown to be necessary, he will in all probability arrive at results of the highest value.

This, we venture to think, has been done in the case of the book before us, and Dr. Newsholme's own conclusions appear to us of no less importance than the statistical details on which they are founded. His general opinion as to the epidemic prevalence of diphtheria is shortly given as follows:—"Diphtheria is spread chiefly by personal infection, but this infectivity is only operative on a large

---

* By Arthur Newsholme, M.D.Lond., etc. London, Swan Sonnenschein & Co. 1898. 196 pp.; 60 Diagrams. Price 7s. 6d. net.

scale under the influence of certain climatic conditions, meteorological and telluric." Of the two main factors in the causation of diphtheria epidemics whose existence is thus affirmed, Dr. Newsholme gives a careful study, in every instance basing his conclusion on the widest range of evidence that can be obtained. In connection with the subject of personal infection he discusses the question of school attendance, maintaining the sensible view that school infection, though a true cause, is only one among many causes of the spread of diphtheria; that it forms in fact "but one incident in a battle, which by no means determines the issue of the entire campaign." He is, however, careful to add, lest the foregoing should be construed into a warrant for dispensing with precautionary measures, that although wider pandemic influences are at times in operation over which we have little control, "we are not justified in abstaining from every effort to minimise the action of these wider causes by preventing personal infection."

The author's views as to these wider influences are admitted by him to rest on evidence of a somewhat more slender kind than that available on the point of infection. The gist of his conclusions is that for an extensive epidemic of diphtheria, a period of more or less continued drought is a necessary antecedent. It is true that the occurrence of rain in the midst of a dry period may lead to, or accompany, a localised outbreak of the disease; but long protracted wet weather appears to be in some way destructive of the infective material. His own theory, which is stated only in the form of a working hypothesis, is as follows:—The specific micro-organism of diphtheria, like that of certain other zymotic diseases, has a double cycle of existence; one phase being passed in the soil, another in the human organism. The optimum conditions for the saprophytic or ground-life of the organism are to be found in a dry and warm subsoil with a low ground-water—these occurring generally in consequence of a deficient rainfall. After the prevalence of such conditions, a lowering of the temperature or diminution of the dryness of the subsoil, or a raising of the level of ground-water, may cause the saprophytic organism to migrate from the soil and assume the parasitic condition.

This hypothesis, which in some respects runs counter to received opinions, is defended by the author with much ability. But the practical sanitarian will note that after all said and done on the subject of climatic influences, Dr. Newsholme is fain once more to emphasize the point that "personal infection is the chief means by which diphtheria is spread" from town to town, and from country to country.

A word of commendation is due to the diagrams with which the book is amply furnished. These are well designed, and as a rule easily read. Being with few exceptions drawn to the same scale, they admit of ready comparison; and, as the author points out, form a substitute, quite adequate in regard to the purpose in view, for the lengthy tabular statements which would otherwise have been necessary.

F. A. D.

SEWER GAS AND ITS INFLUENCE UPON HEALTH.*

In this work the author has critically surveyed all information existing at the present time in reference to sewer gas and its influence upon health, and has formed, by the aid of his own observations and experience, definite conclusions thereon. The conclusions arrived at, and the materials for forming these conclusions are arranged so as to make them a handy means of reference to those interested in the subject.

With this end in view the book has been divided into two main divisions, in the first of which are given, in addition to general observations, the conclusions the author has formed as to the injurious influence of sewer gas upon health; and in the second division he has given in twelve appendixes, the information in reference to sewer gas above referred to. The chapters in the first part of the book are short and practically self-contained, and enable thus even the busy student of sanitary questions to refer to them without much loss of time.

It cannot be supposed that everyone will agree with the views of the author, but it must at any rate be admitted that he has examined the subject free from bias and in a thoroughly impartial spirit, which should recommend the treatise, even to those who may differ from the views expressed therein.

Owing chiefly to the negative bacteriological results on sewer air obtained to the present date, the opinion that sewer gas is practically harmless appears to be gaining ground, and that the elaborate arrangements devised to exclude it from our houses are therefore to some extent unnecessary; the time therefore for publishing this work appears to have been very well chosen.

The author mentions in particular the researches of Mr. Parry Laws on London sewer air; similar conclusions to those arrived at by Laws have been observed by other experimentors from researches made in different parts of the world and under different conditions. The author therefore concludes that the possibilities of sewer air carrying with it the germs of typhoid and thus causing typhoid fever are somewhat remote.

The author then deals with the very important experiments made by Dr. Alessi, of Rome, on the influence of sewer gas upon animals, mentioning the conclusions arrived at by Dr. Alessi which, "serve to confirm what some authors had epidemiologically foreseen, and social hygiene had practically and painfully confirmed."

Concluding his observations the author attributes to sewer gas a direct and an indirect action upon health, the direct action leading to instantaneous death through asphyxia, and the indirect to predisposing the constitution to the pathogenic action of such disease exciting microbes as the bacillus typhi.

The book has been favourably reviewed by (amongst others) *The*

---

* By H. Alfred Roechling, Assoc.M.Inst.C.E. London, Biggs & Co. 224 pp. Price 5s.

Times and *The Lancet*, the concluding remarks of the latter paper that "the collection of evidence and material is a task which Mr. Boechling has accomplished well, and that the thanks of those interested in sanitary advance are due to him," are in entire agreement with our own opinion. C. M.

INLAND SANITARY SURVEY, 1893–95.*

There has been considerable delay in the issue of this report owing to the lamented death of Dr. F. W. Barry, whose able services, as Sir R. Thorne Thorne says, the Medical Department could ill spare. The report is still incomplete, Dr. Barry having only just commenced the introduction with which it was intended to preface the detailed account of the results of the survey.

This detailed account comprises a considerable mass of useful information as to 220 urban districts. But we are not concerned at present with this, but rather with the general question of the relationship between local Medical Officers of Health and Medical Inspectors of the Local Government Board, as illustrated by the comments of the latter on the manner which the former carry out their work, which are scattered throughout this volume.

It may be presumed that the Medical Department of the Local Government Board does not consider that it has purged itself of responsibility when it has placed on record a series of more or less epigrammatic and often disparaging judgments on the way in which Medical Officers of Health in various rural or small suburban districts do or do not do their duties.

The occurrence of such comments as the following is very common: "Knows the defects of his district, but does little work owing to the absence of support from the Sanitary Authority."

How many times since the Act was passed has the Local Government Board put into force the powers conferred upon them by Sec. 299 of the Public Health Act? This section states that "where complaint is made to the Local Government Board," apparently by any one, consequently the medical inspectors of the Local Sanitary Survey might be made practically useful; "that a local authority has made default in enforcing any provisions of this Act which it is their duty to enforce," the Local Government Board *shall* proceed to take certain steps to enforce the carrying out of the provisions of the Act.

The Local Government Board have here a much neglected means of calling to book defaulting Local Authorities, and at the same time, of giving practical support to local medical officers of health. By so doing, the report of their Local Sanitary Survey would cease to have a mere academic effect, and would become a storm signal indicating the necessity for local authorities to put their houses promptly in order, failing which, the compulsory powers of the Local Government Board would be enforced. ED.

* (Supplement to the Report of the Medical Officer of the Local Government Board, 1894–95.) Price 1s. 6d.

ARTICLES RELATING TO PUBLIC HEALTH,

Appearing in the chief British and Foreign Journals and Transactions.*

Abstracts of Titles classified in this List under the following headings:—

Science in Relation to Hygiene and Preventive Medicine.

Anthropology.—Bacteriology.—Chemistry.—Demography.—Geology.—Medicine (Preventive) and Infectious Diseases.—Meteorology.—Microscopy.—Physics.—Physiology.

Hygiene of Special Classes, Trades, and Professions. Municipal Administration.

Schools, Colleges, and Institutions.—Various Trades and Manufactures.—Hospitals.—Prisons.—Naval and Military Hygiene. Barracks and Camps.—Ships.—Workhouses and Asylums.—Artizans' Dwellings.—Municipalities and Municipal Administration.—Burial of the Dead, Cremation, and other means of disposal.—Prevention of Accidents.—Prevention of Fires.

Building Materials, Construction, and Machinery.

Materials and Construction.—Damp-proof Courses.—Paints and other Protectives.—Wall Papers and Coverings.—Flooring.—Decorative.—Machinery and Mechanical.—Laundry.—Dairy.

Water Supply, Sewerage, and Refuse Disposal.

Water Supply.—Filtering, Softening and Purifying Water.—Water Waste Preventers.—Flushing and Watering.—Sinks.—Baths and Lavatories.—Water Closets.—Urinals.—Sewers, Drain Pipes and Accessories.—Traps and Gullies.—Dry Closets.—Sewage Treatment. —Miscellaneous Sanitary Goods.

Heating, Lighting, and Ventilating.

Heating.—Cooking.—Smoke-preventing.—Lighting, including Electric Lighting.—Ventilating Gas Burners.—Ventilators.

Personal and Domestic Hygiene.

Clothing.—Beds and other Furniture.—Hospital and Sick Room. —Domestic.—School Fittings.—Gymnastics.—Foods and Food Supply.—Domestic Filters.—Mineral Waters.—Soaps and other Detergents.—Antiseptics and Disinfectants.—Disinfecting.

Science in Relation to Hygiene and Preventive Medicine.

CIECHANOWSKI and NOWAK. Zur Aetiologie der Dysenterie. *Cent. f. Bakt., Parasit., u. Infektionskrank*, March 17th and 25th, 1898, pp. 445, 493.

Review of literature as to bacteriology, etc. Observations on cases of primary and secondary dysentery of temperate climates. Conclusion that such cases are not due to any single organism, but are probably examples of mixed infection.

---

* A list of the Journals from which the titles are selected is given on p. 300.

BAIL, Dr. OSKAR. Ueber leukocide Substanzen in den Stoffwechselproducten des Staphylococcus Pyogenes Aureus. *Archiv f. Hygiene*, 32nd Vol., 1898, p. 133.

Action of the metabolic products of the Staphylococcus pyogenes aureus on leucocytes; on various bacteria. Course of the intrapleural staphylococcus-infection in rabbits.

VINCENT, M. le Dr. H. Influence de la lumière solaire sur le bacille de le Fièvre Typhoide. *Revue d'Hygiène*, March, 1898, pp. 230—40.

Direct sunlight is fatal to typhoid bacilli in feebly nutrient, but not in highly nutrient, liquids. In vacuo and clean distilled water it kills them in 6½ hours, and in turbid water in 10 hours. The chemical rays of the spectrum kill the bacilli in 3½ hours. Effect of light acting on the bacillus on the surface of the earth, and on linen, &c.

BOUCHER, Dr. H. Les Cas Sporadiques dans les Maladies infectieuses et la doctrine microbienne. *Journal d'Hygiène*, March 17th, 1898, p. 121.

The microbic theory illogical and opposed to certain facts (Sporadic cases) connected with all infectious diseases. Morbid phenomena, sporadic or epidemic, explained by electro-magnetic phenomena of which sporadic cases are the warning.

MAFFUCCI, Dr. ANGELO, and SIRLEO, Dr. LUIGI. Ueber die Blastomyceten als Infections erreger bei bösartigen Tumoren. *Zeit. f. Hygiene*, XXVII., i., 1898, p. 1.

Investigations of the Blastomycetœ as exciting causes of infection in malignant Tumours.

PIANA, G. P., and FIORENTINI, ANGELO. Neuer Beitrag zur Morphologie und Biologie des pathogenen Protozoon (*Protomœba apthogenes*) der Maul und Klauenseuche. *Cent. f. Bakt., Parasit., u. Infektionskrank*, Feb. 27th, 1898, p. 323.

Description, with drawings, of a protozoon found in foot and mouth disease, and believed by the authors to be its specific cause.

SCHOLTZ, Dr. W. Ueber das Wachsthum anaërober Bakterien bei ungehundertem Luftzutritt. *Zeit. f. Hygiene*, XXVII., i., 1898, p. 132.

Experiments illustrating the growth of anaërobic bacteria with free access of air.

SHIGA, KIYOSHI. Ueber den Erreger der Dysenterie in Japan. *Cent. f. Bakt., Parasit., u. Infektionskrank*, April 12th, 1898, p. 599.

A bacillus was found in the dejecta of 34 cases of acute Dysentery and in the intestines of two persons dead of the disease. It gave an agglutinative reaction with the blood of patients suffering from Dysentery. Other bacteria found in these cases did not cause agglutination.

LOEFFLER and FROSCH. Berichte der Kommission zur Erfoschung der Maul und Klauenseuche bei dem Institut für Infektionskrankheiten in Berlin. *Cent. f. Bakt., Parasit. u. Infektionskrank*, March 10th, 1898, p. 371.

Report, in three parts, to the Government on foot and mouth disease, with special reference to immunisation. Experimental evidence that immunity may be produced by inoculation of lymph from vesicles mixed with serum of animals rendered immune by a previous attack of the disease. Evidence from filtration experiments tending to prove the contagium virum is not a protozoon, and that if it be a bacterium it must be much smaller than the smallest yet recognised (not more than one-fifth of the size of the influenza bacillus).

KLEIN, E. Ueber die Verbreitung des anaëroben virulenten Bacillus enteritides sporogenes. *Cent. f. Bakt., Parasit., u. Infektionskrank*, March 31st, 1898, p. 542.

Presence of the bacillus in Sewage from various sources, sewage-effluents, river water, horse-dung, ordinary manure and garden earth, and in street-dust. Not in cow or pig dung. Note of two epidemics of diarrhœa at St. Bartholomew's Hospital attributable to milk containing the bacillus.

DELÉPINE, Professor, M.B., B.Sc. Bacteriological Survey of Surface Water Supplies. *The Journal of State Medicine*, April, May, and June, 1898, pp. 145, 193, and 241.

A consideration of our present position with regard to the value and interpretation of bacteriological results of examination of such waters; and suggesting the adoption of a standard of purity based upon the bacteriological examination of the uncontaminated feeders to the particular gathering ground in question.

PARRY, W. KAYE, M.A., etc. Ammoniacal Nitrogen and the Septic Tank. *The Surveyor*, Jan. 28th, p. 76.

I. The changes which sewage undergoes under the influence of micro-organisms; II. The amount of free ammonia in samples of sewage from septic tank.

BLEIER, OTTO. Ein tragbarer Apparat für hygienische Luftanalysen (Kohlensaüre bestimmung). *Zeit. f. Hygiene* XXVII., i., 1898, p. 111.

A portable apparatus for hygienic analysis of air (estimation of carbonic acid).

EWING, Prof. J. A., F.R.S. Linde's process for producing liquid air. *Engineering*, March 11th, 1898, p. 310.

Description of Apparatus. Composition of liquid air.

CORDIER, —. Biologie des Eaux. *Journal d'Hygiène*, Jan. 6th, 1898, p. 7.

The biological examination of Water Supplies: a comparison of more recent with earlier methods of analysis.

DAVIS, FLOYD. The Interpretation of Sanitary Water Analyses. *The Engineering Magazine*, April, 1898, p. 68.

POUCHET, G., and BOUJEAU, E. Contribution a l'Etude de la Matière Organique des Eaux Potables. *Annales d'Hyg. Pub. et de Med. Liq.*, Ser. 3, Tome 38, 1897, p. 48.

An interesting description of the methods of water analysis pursued in the Laboratory of the Comité Consultatif d'Hygiène Pub.

GRÉHANT, N. Recherche de l'oxyde de carbone dans l'air confiné. *Journal d'Hygiéne*, Feb. 10th and 17th, pp. 69 and 82.

New proofs of absorption of CO. by the blood: Experiments with red-heated cast-iron stoves.

KORN, Dr. OTTO. Die Risselfelder der Stadt Freiburg i. B. *Archiv f. Hygiene*, 32nd Vol., 1898, p. 173.

Chemical and bacteriological investigation of the sewage and drain water.

MARIÉ-DAVY, F. Considérations Statistiques et Climatériques sur la Diphtérie. *Journal d'Hygiène*, Jan. 20th, 1898, p. 25.

Ten years of Diphtheria in Paris. Serotherapy. Disinfection. Diphtheria and variations of temperature. Centres of infection. Climatic influences. Diphtheria in large French and other towns.

ROUXEL. Études sur la Suicide. *Journal d'Hygiène*, Jan. 20th, 1898, p. 25.

Commentary on article by M. Louis Proal. Statistics of suicide from love and intemperance. Increase of suicide in young persons.

BOURDON, M. L'Infanticide dans les Legislations Anciennes and Modernes. *Annales d'Hygiene Publique et de Med. Leg.*, 3 Serie, Tome 37, 1897, p. 186.

A complete historical medico-legal discussion on the subject of Infanticide.

DROUINEAU, M. LE Dr. G. Année Demographique, 1896. *Revue d'Hygiène*, March, 1898, pp. 212 to 230.

Demography of France for the year 1896.

VIGOUROUX, Dr. H. Influence des Passions sur la santé de l'homme. *Journal d'Hygiène*, Feb. 17th, 1898, p. 75.

Effect of different passions in causing disease and death.

BARET, Dr. L. L'Hygiène coercitive: les rejetés de la Société. *Journal d'Hygiene*, 28th April, 1898, p. 193.

A protest against compulsory isolation of the tuberculous, etc. The "omni-contagion" theory of tuberculosis is exaggerated.

RÉGNIER, Dr. L. R. La lutte contre la Tuberculose. *Journal d'Hygiène*, Feb. 3rd, 1898, p. 52.

Study of the progress accomplished in the struggle against Tuberculosis, in relation to habitations, sanatoria. Transmission of the disease from the ox. Heredity. Sterilization of meat. Abattoirs. The Tuberculin test. Tuberculosis in relation to marriage. Village life. School-life. The army.

CHARLIER, Dr. A. L'Hygiène et la Tuberculose pulmonaire. *Journal d'Hygiène*, Feb. 10th, 1898, p. 61.

Commentary on the work by Dr. Cazalas on the "Systematic preventive, and curative treatment of Tuberculosis, by Education or Hygiene, and moral practice." The disease largely due to the condition of the body before the introduction into it of the bacillus. Tuberculosis a diathesis localized in the nerve centres governing the nutrition of the lungs, etc. (Cazalas).

KELSCH, M. le Dr. Note sur la contagion de la Rougeole. *Revue d'Hygiène*, Feb., 1898. pp. 97 to 103.

Evidence of the long duration and the tranmissibility by third persons of the infection of measles.

RÉGNIER, Dr. L. R. La Diphterie et la Sérumthérapie. *Journal d'Hygiène*, March 31st, 1898, p. 145.

The serum treatment of Diphtheria in relation to *Clinical* versus *Bacteriological*. False membrane after serum treatment. Action of the serum on membrane. The serum not like a *Vaccine*. Persistence of the Lœffler bacillus after successful serum treatment.

ÉCHO, Dr. Cause peu connue de la Fièvre Typhoïde. *Journal d'Hygiène*, 7th April, 1898, p. 164.

An outbreak of 300 cases of Enteric Fever in a battalion of infantry in garrison at Saarbruck, due to a potato salad made with unwashed hands by a German soldier just after emptying a latrine!

BLAXALL, FRANK R., M.D., D.P.H. The use of Glycerinated Calf Lymph in Vaccination. *The Medical Magazine*, April, 1898, p. 253.

The preparation of glycerinated calf lymph, and its advantages.

THE EDITOR OF THE "BUILDER." Typhoid at Maidstone. *The Builder*, March 19th, 1898, p. 272.

Editorial note upon Professor Wanklyn's Report on the Maidstone water supply.

WANKLYN, Professor. Typhoid at Maidstone. *The Builder*, March 26th, 1898, p. 302.

Letter from Professor Wanklyn on the failure to discover typhoid bacilli in the Maidstone water supply.

LOCK, Dr. Die Typhusepidemie in Beuthen. *Deutsche Vierteljahrschrift für Öffentliche Gesundheitspflege*, Vol. XXX., Part. II., 1898. p. 241.

The Typhoid Epidemic in Beuthen: a research into the causes of the pollution of a town's water supply derived from deep wells.

ANGLÉ-FERRIÈRE and REMLINGER, MM. Epidémie de Fiévre Typhoide due à l'epandage d'engrais humain. *Revue d'Hygiène*, Feb., 1898, pp. 104 to 127.

Details of an outbreak of Enteric Fever limited to certain squadrons (Chasseurs d'Afrique) stationed in Tunis, due to night-soil used as manure, the dust of which was blown about in dry and windy weather. Cause proved by bacteriological examination of the dust collected in room, &c.

RÉGNIER, Dr. L. R. La Peste aux Indes et la préservation de l'Europe. *Journal d'Hygiène*, March 10th, 1898, p. 109.

Causes of spread of the Plague in India, are absence of physicians who understood how to deal with it, and want of a sanitary service. Native objections to sanitary regulations. Tardiness of British and Turkish Governments to prohibit pilgrimages to Mecca. Importance of medical independent control over Navigation Companies.

PETRUSCHKY, J. Ueber Massenasscheidung von Typhusbacillen durch den Urin von Typhus-Rekonvalescenten und die epidemiologische Bedeutung dieser Thatsache. *Cent. f. Bakt., Parasit., u. Infektionskrank*, 12th April, 1898, p. 577.

Confirmation of the observations of Wright and Semple (*Lancet*, 1895), and of Horton Smith (*Med.-Chi. Trans.*, Vol. LXXX., 1897, p. 141), that typhoid bacilli may be present in large numbers in the urine of patients recovering from typhoid. Evidence that the urine is infective to man. Effect of improved water supply on death-rate from typhoid fever in Dantzig.

NUTTALL, GEORGE, H. F. Zur Aufklärung der Rolle, welche stechende Insekten bei der Verbreitung von Infektionskrankheiten spielen. *Cent. f. Bakt., Parasit., u. Infektionskrank*, April 16th, 1898, p. 625.

Experiments on mice with bugs and fleas, tending to show that these insects can seldom, if ever, act as carriers of infection (of plague, anthrax, chicken-cholera, mouse septicœmia), owing to the early destruction of the microbes in the insects.

VALLIN, Dr. E. 1. Les Salons de Coiffure. 2. Les Nouvelles Allumettes. *Revue d'Hygiène*, Jan., 1898, p. 2.

1. Propagation of Contagious Diseases by instruments used in Hairdressing, &c., and its prevention. 2. "Triumph" Matches without phosphorous, contain lead and are therefore dangerous. A non-poisonous match free from lead and harmless, of a new type, is stated to have been lately perfected by the Engineers of the French Government.

BATTLEHNER, Dr. F. (Karlsruhe). Die Verbreitung von ansteckenden Krankheiten in Badeorten und Sommerfrischen; schutzmaassregeln für die Bewohner und Besucher solcher Orte. *Deutsche Vierteljahrsschrift für Offentliche Gesundheitspflege*, 1st Heft, 1898, p. 216.

The Spread of Infectious Diseases in Watering-places and Holiday Resorts. Preventive measures for residents and visitors.

RÉGNER, Dr. L. R. Syphilis et Prostitution. *Journal d'Hygiène*, 5th May, 1898, p. 205.

The State regulation of prostitution. British Army statistics of syphilis. Prostitution difficult to define. Class of prostitutes most likely to spread disease. Danger of clandestine prostitution. It is not regulation, but the system employed which is faulty. Limited extent of surveillance in Paris, and its results. Measures adopted in Spain, Germany, Brussels. Proposals.

TARNOWSKY, Prof. B. Lutte contre la Syphilis. *Annales d'Hygiène Publique et de Méd. Leg.*, 3 serie, Tome 35, 1897, p. 193.

Draws forceful attention to the magnitude of the evil in Russia, and advocates steady and persistent coöperation of doctors, also dissemination of information among the public.

REGNIER, Dr. L. R. La lutte contre la Tuberculose dans l'armée et dans les Hôpitaux de Paris. *Journal d'Hygiène*, Feb. 17th, 1898, p. 73.

Extent of Tuberculosis in Paris, and measures taken for its prevention. Disinfection. General Sanitation. Hospital Isolation. Education in preventive measures.

WILSON, HERBERT M. The Relation of Forestation to Water-Supply. *The Engineering Magazine*, Feb., 1898, p. 807.

Discusses the effect of Forests on the amount of the rainfall available for water supply.

ROUXEL. Sur le Climat de la France. *Journal d'Hygiène*, Jan. 13th, 1898, p. 16.

A criticism of an article by M. Pelletan. Sensations and Vine culture, etc., show a lower temperature than formerly. Loss of internal heat of earth. Maury's theory of the Gulf Stream unsatisfactory.

COURMELLES, Dr. FOVEAU DE. L'Hygiène de la peau dans la première enfance. *Journal d'Hygiène*, Jan. 13th, 1898, p. 23.

Physiology of the skin in infancy.

Hygiene of Special Classes, Trades and Professions, and Municipal Administration.

NUSSBAUM, Prof. H. CHR. (Hannover). Die vorzüge der schulgebäudeanlagen in Pavillionsysteme durchführbar für die Aussenbezirke der Städte. *Deutsche Vierteljahrsschrift für Offentliche Gesundheitspflege*, 1st Heft, 1898, p. 134.

Advocating the construction of schools in separate pavilions rather than in many storied buildings.

KERMAUNER, M. le Dr., and PRAUSUITZ, le Prof. L'Eclairage indirect dans les Ecoles. *La Technologie Sanitaire*, Jan. 1st, 1898, p. 261.

The hygienic and economic advantages of indirect lighting of schools.

HYGIENIC INSTITUTES. *The Journal of State Medicine*, Jan., Feb., and March, 1898.

Descriptions of the Hygienic Institutes and Laboratories at Berlin, Paris, Rome, Moscow, Utrecht, and St. Petersburg.

DE COURMELLES, Dr. FOVEAU. L'Hygiène des Demoiselles de Magasin. *Journal d'Hygiène*, Jan. 27th, 1898, p. 45.

Health of Shop-girls. Effect of prolonged standing.

BERTHENSEN, Dr. LEO (St. Petersburg). Die Naptaindustrie in Sanitärer Beziehung. *Deutsche Vierteljahrschrift für Offentliche Gesundheitspflege*, Vol. XXX., Part II., 1898, p. 315.

The Sanitation of the Naphtha Industry: a review of the hygiene of the industry from the boring for Petroleum to the production of the refined materials, to which is appended a bibliographical index.

MARTIN, Le Dr. A. J. L'Hopitalisation Moderne. *Revue d'Hygiène*, Feb., 1898, pp. 134 to 154.

Description of the New "Hôpital Boucicaut" in Paris (for Medical, Surgical, and Maternity Cases). The Tuberculous cases on the Medical side and the Suppurating cases on the Surgical side, are treated in separate pavilions. The spittoons and other appliances are sterilized in a special apparatus after use.

SANTA, JOSEPH DE PIETRA. Hygiène Militaire, la Chaussure. *Journal d'Hygiène*, Feb, 24th and March 24th, 1898, pp. 85 and 133.

Military Medical Statistics. The Barrack of the Quai d'Orsay. —— Importance of the boot in the role of national defence, understood by Napoleon, Wellington, and certain great commanders of the past. Various foot coverings considered.

VALLIN, Le Dr. E. La Valeur hygiènique comparée des Planchers et des Dallages. *Revue d'Hygiène*, March, 1898, pp. 193—212.

The Sanitary advantages—especially for barracks, &c.—of cemented, instead of wood flooring, and the trivial difference of effect between the two on the temperature of the air of rooms, as shown by experiment.

RICHARD, Dr. E. Les Habitations à bon marché d'Ostheim. *Rev. d'Hygiène*, Jan., 1898, pp. 8—21.

Description of a "delicious little town" of labourers' dwellings not far from Stuttgart, began in 1891 by the "Society for the welfare of the Working Classes," erected out of funds subscribed by the inhabitants of Stuttgart, and at present comprising 253 houses occupied by 4,500 persons (800 families).

CACHEUX, E. Habitations Ouvrières. *Journal d'Hygiène*, Jan. 20th, 1898, p. 33.

Reports of Inspectors of Labour in Austria. Insufficiency of house accommodation. Attempts to improve existing dwellings result in higher rents.

——— Habitations à bon Marché en Allemagne. *Journal d'Hygiène*, Jan. 13th, 1898, p. 21.

Details relating to several German towns in which the municipality aid in the erection of small dwellings, by affording cheap sites, pecuniary subscriptions, or loans.

BIGGS, HERMAN M. Address on Public Health. *American Medico-Surgical Bulletin*, Jan. 10th, 1898, p. 9.

Detailed account of the Public Health Department of New York.

LEUCH, Dr. STADTARZT. Vom Desinfectionsdienst in der Stadt Zürich. *Deutsche Vierteljahrschrift für Offentliche Gesundheitspflege*, Vol. XXX., Part II., 1898, p. 305.

The Disinfection Service of the Town of Zurich; methods and regulations for public disinfection.

CONNOR, EDWARD. Is Wood-Pavement Injurious to Health? *Local Government Journal*, Jan. 22nd, 1898, p. 58.

Discussion of opinions in France on this question.

WARING, COL. GEORGE E., Junr. Street Cleaning in New York. *Engineering Record.* Jan. 8th, 1898, p. 121.

Street cleaning. Comparative cost of cleaning Asphalt, Granite, and Belgian pavements. Mechanical refuse disposal plant.

BLAYAC, Dr. E. Nouvelle réglementation des Crèches. *Journal d'Hygiene*, April 14th, 1898, p. 171.

Regulations published in the "Journal Officiel" for Crèches, with comments.

LOESENER. Ueber das Verhalten von Pathogenen Bakterien in beerdigten Kadaveren. *Arbeiten aus daus Kaiserlichen Gesundheitsamte*, v. 12, f. II., p. 448.

Discusses the limits of danger from cemeteries.

MOORE, FRANCIS C. The Construction of Slow-burning Buildings. *The Engineering Magazine*, March, 1898, p. 955.

Describes methods of rendering dwellings less liable to destruction by fire.

LAWSON, A. W., Assoc.M.Inst.C.E. Ingress and Egress at Public Buildings. *The Surveyor*, Feb. 4th, 1898, p. 123.

Report upon additional provision for safety needed in places of public resort as to means of ingress and egress.

Building Materials, Construction, and Machinery.

PATERSON, A. N., M.A., A.R.I.B.A. A Study of Domestic Architecture in the Eastern States of America in 1896. *Journal of The Royal Institute of British Architects*, Vol. V., 3rd Series, 23rd April, 1898, p. 309.

Special reference to questions of plan, construction, heating, drainage, &c.

HILL, GEORGE, Assoc.M.Am.Soc.C.E. Concrete Floor Tests. *Engineering Record*, Jan. 8th and 15th, 1898, pp. 78 and 105.

Results of series of tests of Concrete Flooring of varying proportions and thicknesses.

Water Supply, Sewerage, and Refuse Disposal.

BERRINGTON, R. E. W., Assoc.M.Inst.C.E. The Sources of Town Water Supplies and their bearing upon Public Health. *The Surveyor*, June 3, 1898, p. 591.

Sources of Town Water Supply. Advantages of soft water. Effect on iron and lead. Rivers and springs. Importance of efficient water supply.

PEARSON, H. W., M.Inst.C.E. Springs and Wells for Town Supplies. *The Surveyor*, Feb. 18th, 1898, p. 176.

Well sinking sites. Chalk formation. New red sandstone wells. Forms of well. Cost of sinking wells, &c.

FOX, WILLIAM, M.Inst.C.E. Reservoir Embankments. *The Surveyor*, March 11th, 1898, p. 252.

Depth and form of foundation. Form of Embankment. Description of reservoirs at Forfar, Cheltenham, and Bath.

STRANGE, W. L., A. M. Inst. C. E. Reservoirs with High Earthen Dams. *Engineering*, Jan. 28th, 1898, p. 121.

The subject dealt with specially as regards reservoirs in Western India.

LUX, F. The Coupling of Water Meters. *The Surveyor*, Jan. 7th, 1898, p. 4.

Valves to register. Small quantities of water per unit of time. Comparison of weighted, spring, and hydraulic valve. The differential hydraulic valve.

PENNINK, J. M. K. Tuyau en Plomb armé de fils d'acier, *La Technologie Sanitaire*, March 1st, 1898, p. 370.

Description of steel-bound leaden pipes as used for conveyance of water under the river Y at Amsterdam.

DUNLOP, T., M.B., D.P.H. A Rural District Water Supply. *The Journal of State Medicine*, June, 1898, p. 253.

Describes a scheme for supplying a portion of a rural district in Essex with drinking-water from a spring; how the scheme originated, was carried through, and the satisfactory results which followed.

THRESH, JOHN C., M.D., D.P.H. The Inspection of Water Supplies. *The Journal of State Medicine*, Jan., 1898, p. 1.

Points out the importance of preventing the pollution of water supplies, and the desirability of Water Companies and Sanitary Authorities acquiring sufficient of the land around springs and wells to constitute "a protective area," over which they could exercise absolute control and thus prevent pollution. Special reference is made to subsoil water supplies.

JÄGER, Dr. H. Die beabsichtigte einleitung der Abwässer von Stuttgart in den Neckar und die hiergegen erhobene einsfriache seitens der fluss-abwärts liegenden Gemeinden. *Zeit. f. Hygiene*, XXVII., i., 1898, p. 73.

The pollution and self-purification of the river Neckar, the relation of the river water to subsoil water in its neighbourhood—investigated by chemical and bacteriological methods; also by observations of the temperature of these waters respectively.

CAMESCASE, Dr. JEAN. Pollution des Puits et des Sources. *Revue d'Hygiène*, Jan., 1898, pp. 21 to 27.

Danger of pollution of well waters from porous ground—protective measures.

GÄRTNER, Dr. A. (Hofrath, Jena), and HERZBERG, A. (Baurath, Berlin). Vortheile und Nachtheile der getrennten Abführung der Meteorwässer bei der Canalisation der Städte. *Deutsche Vierteljahrsschrift für Offentliche Gesundheitspflege*, 1st Heft, 1898, p. 52.

A comparison of the separate and combined systems of sewerage in various sized towns.

STÜBBEN, J. (Cologne). Die Schwemmcanalisation in Frankreich. *Deutsche Vierteljahrschrift für Offentliche Gesundheitspflege*, Vol. XXX., Part II., 1898, p. 340.

The Water-carriage System of France: a brief comparison of the position of the water-carriage system of sewerage in European cities, with especial reference to Paris and the Seine.

LOVEGROVE, E. J., Assoc.M.Inst.C.E. Drainage of New Buildings. *The Surveyor*, Jan. 28th, 1898, p. 97.

The Drainage of New Buildings in Hornsey in respect to systems adopted in other Municipal towns and Districts. Report to Hornsey U.D.C.

JENKINS, R. J. House Drainage: Its Inspection and Testing. *The Surveyor*. April 1st, 1898, p. 332.

Access; stoppers; test; water test; smoke test; chemical test.

CERVIN, OLOF. Z. Plumbing Regulations of Moline, Ill. *Engineering Record*, Jan. 29th, 1898, p. 147.

Regulations as to Examinations, Licenses, Permits, House Drainage, Soil and Waste Pipes, &c., and Tests in force in Moline.

RIDEAL, SAMUEL, D.Sc.Lond., F.I.C. Purification of Sewage by Bacteria. *Local Government Journal*, Feb. 19th, 1898, p. 123.

History of the subject—Description of Scott Moncrieff, Exeter, Sutton, and Ducat systems—Results.

WHYATT, GILBERT, Assoc.M.Inst.C.E. Sewage Purification: The Salford Experiments. *Building News*, Feb. 18th, 1898, p. 225.

Present position of sewage problem; various systems of purification; Salford experiments.

DARLEY, GEORGE (Leeds). Refuse Disposal. *Sanitary Inspectors' Journal*, Feb., 1898, p. 214.

Detailed description of Horsfall's Destructors as in use at Leeds.

MEYER, F. ANDREAS (Chief Engineer, Hamburg). Mittheilungen über den Stand der Kehrichtverbrennung in Deutschland. *Deutsche Vierteljahrsschrift für Offentliche Gesundheitspflege*, 1st Heft, 1898, p. 9.

List of refuse destructors in England. Experiments in Berlin and Hamburg. Description of Hamburg destructors.

BLAYAC, Dr. E. Enlévement, Utilisation et Destruction des Gadoues. *Journal d'Hygiene*, April 7th, 1898, p. 157.

Summary of a series of nine recent reports and documents, published by the Parisian Commission, on the removal and treatment of domestic and street refuse.

Heating, Lighting, and Ventilating.

SPATARO, Prof. DONATO. Orientation et largeur des Rues en rapport avec l'insolation des habitations. *Rev. d'Hygiène*, Jan. and Feb., 1898, pp. 27 and 127.

Calculations of the amount of heat and light from the Sun entering dwellings in relation to the width and direction of the streets.

MEIDINGER, Prof. Dr. H. HOFRATH. Die Heizung von Wohnräumen. *Deutsche Vierteljahrschrift für Offentliche Gesundheitspflege*, Vol. XXX., Part II., 1898, p. 264.

The Warming of Habitable Buildings, mainly upon the distribution of temperatures by convection and radiation from various forms of stoves.

FARROW, FREDERIC R., F.R.I.B.A. The Warming of Public Buildings. *Journal of The Royal Institute of British Architects*, Vol. V., 3rd series, No. 13, May 7th, 1898, p. 347.

Warming Buildings by hot air, hot water (low and high pressure), and steam, various kinds of radiators and boilers, and calculations for the provision of heating power.

BLACKMORE, J. J. The Hot-Water System for the Heating of Buildings. *The Engineering Magazine*, Feb. and April, 1898, pp. 28 and 817.

Describes the different systems for heating buildings by means of hot water.

——— Systems and Apparatus for Heating Buildings by Steam.

Describes the different systems and apparatus for heating buildings by means of steam.

MARSHALL, C. T., M.S.A. Acetylene Gas. *Building News*, March 11th, 1898, p. 336.

History of the Gas. Composition of Acetylene. Impurities and how they may be overcome.

SAUNDERS, J. L. European Systems of House Heating. *The Engineering Magazine*, Jan., 1898, p. 635.

The house-heating practice in Great Britain compared with that current in America.

Personal and Domestic Hygiene.

RUBNER, MAX. Experimentelle Untersuchungen über die modernen Bekleidungs-systeme. *Archiv f. Hygiene*, 32nd Vol., 1898, p. 1.

Experiments to test the value of different kinds of clothing in relation to the needs of the body.

LEFFMAN, HENRY. Note on the tests for distinguishing boiled from unboiled milk. *The Analyst*, April, 1898, p. 85.

RICHMOND, H. DROOP. The Composition of Milk and Milk Products. *The Analyst*, April, 1898, p. 89.

Consists of notes on observations rising out of the analysis of 35,007 samples of milk, &c., in the Aylesbury Dairy Company's Laboratory.

JORISSENNE, Dr. Nouvelles recherches sur la digestibilité des œufs et specialement de l'albumine. *Journal d'Hygiène*, March 17th and 24th, 1898, pp. 131 and 143.

The evil effects of eating eggs often due to abuse. Action of acids and alkalies, &c., &c., on albumen in relation to digestion. The different digestibility of the white and the yolk of egg and circumstances affecting it.

CACHEUX, E. Accidents causés par l'ingestion des Moules et des Huitres. *Journal d'Hygiène*, March 3rd, 1898, p. 107.

Poisoning by mussels and oysters.

CARLES, Dr. P. Recherche et dosage du plomb dans les fers-blancs et dans les conserves alimentaires. *Journal d'Hygiène*, Feb. 10th, 1898, p. 64.

Lead in preserved fruits and tinned iron boxes, and its detection.

JEAN, FERDINAND. Les Matières alementaires Aseptisées Chimiquement. *Journal d'Hygiène*, Jan. 6th, 1898, p. 10.

Against the employment of chemical preservatives in foods.

RÜMELIN (Mayor of Stuttgart) and BECKURTS, Prof. Dr. (Brunswick). Die Nahrungsmittelfälschung und ihre Bekämpfung. *Deutsche Vierteljahrsschrift für Öffentliche Gesundheitspflege*, 1st Heft, 1898, p. 101.

The Adulteration of Food and its Prevention. The position of the question in Germany: A plea for standards of composition and qualifications for specialists.

TUCZEK, Professor Dr. (Marburg). Die Bekämpfung des Alkoholmissbrauchs. *Deutsche Vierteljahrsschrift für Offentliche Gesundheitspflege*, 1st Heft, 1898, p. 21.

The causes and prevention of the abuse of alcohol—private, social, and legal means of prevention.

ABBA, Dr. F., und RONDELLI, Dr. A. Das Formaldehyd und die Offentlichen desinfectionen. Experimentelle studi. *Zeit. f. Hygiene*, XXVII., i., 1898, p. 49.

Experimental investigation of the penetrating action and germicidal power of formaldehyde gas at various temperatures.

FAIRBANKS, A. W., and GRAWITZ, E. Experimentelle Untersuchungen über Zimmerdesinfektion mit Formaldehyddämpfen. *Cent. f. Bakt., Parasit., u. Infektionskrank*, Jan. 8th, 19th, 31st, 1898, pp. 20, 80, and 138.

The mode of using pastilles of polymeric formaldehyde (trioxymethylen which yields formaldehyde gas when heated) for the disinfection of rooms, with an account of bacteriological experiments on the efficiency of the method. Prof. E. Grawitz appends a note describing the method followed by him for the disinfection of hospital wards with formaldehyde.

FAIRBANKS. A. W. Weitere Versuche über Formaldehyd Desinfektion. April 30th, 1898, p. 689.

Action more rapid in a room warmed (by steam) to 22° C. (71·6° F.).

V. ESMARCH, Prof. E. (Königsberg), and ZWEIGERT (Mayor of Essen). Die Wohnungsdesinfection in wissenschaftlicher und praktischer Hinsicht. *Deutsche Vierteljahrsschrift für Offentliche Gesundheitspflege*, 1st Heft, 1898, p. 156.

Theoretical and practical points in disinfecting dwelling-rooms.

SCHULTZ, N. K. Ueber die Einwirkung der Antiseptica auf den Bac. pestis hominis und die Desinfektion von Gegenständen und geschlossenen Räumen bei Bubonenpest. *Centralblatt für Backteriologie Parasitkenkunde, und Infectionskrank*, April 12th, p. 594.

Formaldehyde gas best for disinfection of rooms, furniture, utensils, furs, clothes, &c.; corrosive sublimate which acts more rapidly best as a disinfectant in solution.

JOURNALS AND PUBLICATIONS FROM WHICH THE TITLES ARE SELECTED.

BRITISH.

British Medical Journal. Weekly.
Builder. Weekly.
Building News.

Engineering. Weekly.
Journal of Gas Lighting, Water Supply, and Sanitary Improvement. Monthly.
Journal of Pathology and Bacteriology. Quarterly.
Journal of the Royal Institute of British Architects. Fortnightly.
Journal of the Royal Statistical Society.
Journal of State Medicine. Monthly.
Journal of The Sanitary Inspectors' Association. Monthly.
Lancet. Weekly.
Local Government Journal. Weekly.
Medical Magazine. Monthly.
Minutes of Proceedings of the Institution of Civil Engineers. Quarterly.
Proceedings of the Society of Chemical Industry. Monthly.
Public Health. Monthly.
Public Health Engineer. Weekly.
Sanitary Record. Weekly.
The Analyst. Monthly.
The Engineer. Weekly.
The Surveyor and Municipal and County Engineer. Weekly.
Transactions of Surveyors' Institution. Monthly.

AMERICAN.

American Medical and Surgical Bulletin.
The Engineering Magazine.
The Engineering Record and Sanitary Engineer.

FRENCH.

Annales d'Hygiène Publique. Monthly.
Annales de l'Institut Pasteur. Monthly.
Annales des Ponts et Chaussées. Monthly.
Journal d'Hygiène. Weekly.
La Technologie Sanitaire. Monthly.
Revue d'Hygiène. Monthly.
Revue des Sciences Medicales. Quarterly.

GERMAN.

Archiv für Hygiene. Quarterly.
Berliner Klinische Wochenschrift. Weekly.
Centralblatt für allegemeine Gesundheitspflege. Monthly.
Centralblatt für Backteriologie v. Parasitenkunde u. Infektionskrank. 2 vols. Yearly.
Deutsche Vierteljahrsschrift für Offentliche Gesundheitspflege. Quarterly.
Deutsche medizinische Wochenschrift. Weekly.
Gesundheits-Ingenieur. Fortnightly.
Zeitschrift für Hygiene. Monthly.
Zeitschrift für Fleischn Milch-Hygiene.

SPANISH.

La Higiene Popolar.

NOTES ON BOOKS AND PAPERS IN TRANSACTIONS.

"The Municipal and Sanitary Engineers' Handbook," by H. Percy Boulnois, M.Inst.C.E. Third Edition, revised and enlarged. 474 pp., 8vo. *E. & F. N. Spon.* London, 1898. Price 15s.

This well-known Handbook, dealing with the various subjects that come within the duties to be performed by the Municipal Engineer, has been enlarged and brought up to date, the last edition having been published in 1892.

"Sanitation in the British Mercantile Marine," by Wm. G. Romeril. 63 pp., 8vo. *Shipping World Co., Ltd.* London, 1898. Price 5s.

The volume contains the results of the author's experience at Sea and in Port Sanitary work, the object being to bring forward the chief features in connection with Sanitary matters in the Mercantile Marine, for the information of Ship-owners, Ship-Officers, Port Sanitary Inspectors and others.

Chapters I.-VIII. have already appeared in the Quarterly Journal of the Institute, but two chapters have been added dealing with "Drinking-water Tanks" and an "Inquiry into Deaths of Seamen at Sea."

There are a number of illustrations.

"Street Cleaning and the disposal of a City's Wastes; Methods and results, and the effect upon public Health, public Morals, and Municipal Prosperity," by George E. Waring, Jun. 230 pp., 8vo. *Gay & Bird.* London, 1898. Price 5s.

Col. Waring here reviews the whole subject, more especially in reference to New York during his administration as Commissioner of Street Cleaning of the City. There is a Report on Street Cleaning in Europe, from the author's observations, made in 1896, in Vienna, Budapest, Berlin, Paris, Birmingham, Brussels, Munich, Cologne, Turin, and Genoa.

"Sanitary Engineering," by Wm. Paul Gerhard, 132 pp., 8vo. New York, 1898.

The Author in this Volume seeks to review the ground covered by the term "Sanitary Engineering," which he holds that like "Electrical Engineering" is one of the recent Branches of Civil Engineering. Some of the headings under which the subject is discussed are the following:—Architecture and Engineering, Definition of Civil

Engineering, Engineering Specialities, Definition of Sanitary Engineering, Course of Study in Sanitary Engineering, Practice of a Sanitary Engineer, Qualifications of a Sanitary Engineer. These are the chief headings of the chapters, there are a number of sub-headings in which are discussed the details of a Sanitary Engineer's work in relation to Water Supply, Sewerage, Pollution of Water Courses, Outbreaks of Epidemics, &c., &c.

MEETINGS HELD APRIL TO JUNE, 1898.

SESSIONAL MEETING.

A meeting was held on April 6th, when a discussion was opened R. E. Middleton, M.Inst.C.E., M.Inst.M.E., on "The Desirability making Watershed Areas and Sanitary Districts Coterminous." J. Symons, F.R.S., in the chair. About 40 Members, Associates, and Visitors attended (see p. 265).

EXAMINATIONS.

At an Examination in Practical Sanitary Science, held in Birmingham on April 1st and 2nd, 1898, 4 Candidates presented themselves.

The following 2 Candidates were granted Certificates in Practical Sanitary Science :—

1898, Apr. 2. FLEMING, RICHARD PHILIP, 84, Commercial Street, Dundee, N.B.

1898, Apr. 2. WOODS, WALTER HARRY, Meadow View, Belper, near Derby.

At an Examination for Inspectors of Nuisances, held in Birmingham on April 1st and 2nd, 1898, 30 Candidates presented themselves.

The following 10 Candidates were certified, as regards their Sanitary Knowledge, competent to discharge the duties of Inspectors of Nuisances :—

1898, Apr. 2. BANNINGTON, BERTRAM GEORGE, 36B, Raglan Street, Coventry.

1898, Apr. 2. BARNES, WILLIAM, Pool Street, Aston, Birmingham.

1898, Apr. 2. BIRD, GUELPH JOHN, Heath Street, Victoria Road, Tamworth.

1898, Apr. 2. BRALEY, FRANCIS CHARLES, Vera Cottage, Knighton Lane, Aylestone Park, Leicester.

1898, Apr. 2. BROMLEY, ALAN, Borough Surveyor's Office, Sutton-Coldfield.

1898, Apr. 2. Cooper, Charles William, 15, Albert Road, Liverpool.
1898, Apr. 2. Gough, Thomas, 25, Granton Road, Everton, Liverpool.
1898, Apr. 2. Hudson, Thomas, Bradley Road, Silsdon, near Keighley.
1898, Apr. 2. Merrifield, Frederick, Sutton-Coldfield.
1898, Apr. 2. Nichol, Jonathan, Brayton, *viâ* Carlisle.

Examination Questions.

Practical Sanitary Science.—Birmingham, April 1st & 2nd, 1898.

Paper I.

1. What conditions favour the solvent action of water on lead pipes? What quantity of lead in water is considered dangerous, and how may the dangers of lead poisoning be obviated?

2. What is meant by the term *relative humidity* and how is it determined? What bearing has humidity on the climatic conditions of a country?

3. Explain what is meant by specific gravity. How would you determine the specific gravity—

(*a*) of a solid? (*b*) of a liquid?

4. Explain the construction of a rain gauge and give rules for its position. What is the average rainfall at Greenwich? What quantity does a fall of one inch per acre represent?

Paper II.

5. Describe briefly the constituents and the manufacture of an ordinary brick. Describe at least two methods of making secure foundations in subsoils charged with water.

6. What traps are admissible in a good system of house drainage? Give sketches of each, describing briefly under what conditions they would be used.

7. State the advantages and disadvantages of the combined and the separate systems of sewerage of a town, and what conditions generally determine the adoption of either.

8. What are the powers of a Sanitary Authority with reference to—

(*a*) The removal of a case of infectious disease to hospital?
(*b*) Nuisance arising from pig-keeping?

The Candidates were examined vivâ voce *on the 2nd.*

Inspectors of Nuisances.—Birmingham, April 1st & 2nd, 1898.

1. What powers have been given to Local Authorities with regard to caravans, tents, and sheds, occupied as dwellings, and under what Acts of Parliament?

2. State the most important provisions of the Milkshops, Dairies, and Cowsheds Order of the Privy Council, June, 1885, and mention any points that should be specially provided for by By-Laws under this Order.

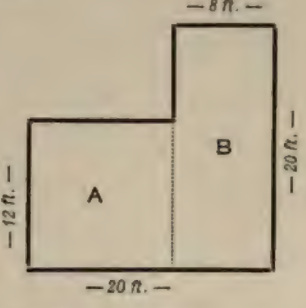
3. In what circumstances are you justified in entering upon private premises to examine a drain? What is the procedure required by the Public Health Act, 1875, and what provision is made against obstruction by the owner or occupier?

4. How would you proceed to investigate the sanitary condition of a small country dwelling? Give the headings of your report thereon.

5. What measures are generally employed to prevent nuisance from effluvia arising from Artificial Manure Works?

6. The surface wells in a village are all found to be polluted, what steps might be taken to give a reasonably safe supply of water if a supply from public mains was not available?

7. The annexed sketch is the plan of a room, the portion marked A being 9 ft. high, and the portion marked B being 10 ft. 6 in. high, what are the cubical contents? How many persons may be allowed to sleep in it?



8. Sketch the following traps, showing the water level when at rest, state the advantages and disadvantages of each kind—

D. Trap. Bell Trap. P. Trap.
S. Trap. Mason's Trap.

The Candidates were examined vivâ voce *on the 2nd.*

At an Examination in Practical Sanitary Science, held in London on May 6th and 7th, 1898, 12 Candidates presented themselves.

The following 5 Candidates were granted Certificates in Practical Sanitary Science:—

1898, May 7. ACKERMANN, ALFRED SEABOLD ELI, 53, Victoria Street, S.W.
1898, May 7. BATES, HENRY, 100, Bunhill Row, E.C.
1898, May 7. HENLEY, WILLIAM CUMMING, Duke St., Dartmouth.
1898, May 7. HIPKIN, JOHN, The Manor House, Bedhampton, Havant, Hants.
1898, May 7. OLIVER, GILBERT THOMAS INGLIS, The Archers, Woodchester Road, Stroud, Gloucester.

At an Examination for Inspectors of Nuisances, held in London on May 6th and 7th, 1898, 109 Candidates presented themselves.

The following 64 Candidates were certified, as regards their Sanitary Knowledge, competent to discharge the duties of Inspectors of Nuisances:—

1898, May 7. BAGSHAW, DAVID, 38, Beatrice Street, Plaistow, E.
1898, May 7. BARKER, WILLAM, 16, Butt Road, Colchester.
1898, May 7. BATES, WILLIAM JOHN, 101, Sussex Road, Holloway, N.
1898, May 7. BEST, GEORGE, 16, Alfred Hill, Kingsdown, Bristol.
1898, May 7. BROWN, HERBERT EDWARD, 80, Grenard Road, Peckham.
1898, May 7. BURRELL, TOM LEONARD, 24, Lordship Lane, Wood Green, N.
1898, May 7. CALLOW, HARRY, Ferndale, 23, Arodene Road, Brixton Hill, S.W.
1898, May 7. *L* CORDNER, Miss EDITH HELENA, Torbay Mount, Torquay.
1898, May 7. DAVIS, GEORGE EDWARD JAMES, 4, Lupus Street, St. George's Square, S.W.
1898, May 7. DAVY, SAMUEL NICHOLAS, The Coroner's Court, Cambridge Street, St. Pancras, N.W.
1898, May 7. DOWELL, JOHN EDWARD, 36, Havelock Road, West Kensington Park, W.
1898, May 7. DUNKIN, HENRY LLEWELLIN, 55, Brand Street, Greenwich.
1898, May 7. FARAGHER, EDWARD HERBERT, 7, Myrtle Street, Douglas, Isle of Man.
1898, May 7. FEW, EDWIN, 17, Highbury Park, N.
1898, May 7. GEDGE, EDWIN DOWSING, 45, Arliss Road, Lavender Hill, S.W.
1898, May 7. GOWEN, WILLIAM HERBERT STEVENS, Roundstone Street, Trowbridge, Wilts.
1898, May 7. GRIGGS, WILLIAM JAMES, 16, Alma Square, St. John's Wood, N.W.
1898, May 7. GWILLIM, FRANK ARCHER, Cwm Dulas, Pontinlas, Hereford.
1898, May 7. HARDY, HERBERT ROBERT, 23, Pitt Street, Norwich.
1898, May 7. HAWKE, WILLIAM, 11, Truro Road, St. Austell.
1898, May 7. HULL, THOMAS WILLIAM, 1, Southmoor Rd., Oxford.
1898, May 7. HYDE, HOWARD LIGHT, Ruby Villa, Pultney Road, Enfield Wash.
1898, May 7. JONES, ISAAC RICHARD, 18, Lucretia Road, Kennington, S.E.
1898, May 7. JONES, WILLIAM DAVID, 6, Dufours Place, Golden Square, W.
1898, May 7. JONES, WILLIAM PHILLIP, U. D. Council Office, Cymmer, R. S. O.

1898, May 7. LANG, ARTHUR EDWARD, 30, Tottenham Street, Gt. Yarmouth.

1898, May 7. LESTER, ARTHUR JAMES, 5, Perrymead Street, Fulham, S.W.

1898, May 7. LONGDEN, CHARLES MATTHEW, 2, Warwick Place, W.C.

1898, May 7. LUKE, PERCIVAL WILLIAM, 12, Percy Road, Queen's Road, Gosport.

1898, May 7. *L* MALONE, Miss ANNIE, 4, Brunswick Square, W.C.

1898, May 7. MARKHAM, SIDNEY SEPTIMUS, 67, Springdale Road, Stoke Newington, N.

1898, May 7. *L* MAYNARD, Miss EDITH LOUISA, Wolsey House Harrow.

1898, May 7. MAYNARD, SAMUEL JAMES, 19, Lisson Residences, Lisson Street, N.W.

1898, May 7. MELHUISH, FRANK WHIDDON, M.R.C.V.S., Health Department, Sydney, Australia.

1898, May 7. *L* MENNELL, Miss CHRISTABEL, The Red House, Croydon.

1898, May 7. MITCHELL, GEORGE, Derby Union, Uttoxeter Road, Derby.

1899, May 7. *L* NEVILE, Miss CATHERINE ALICE, 3, Blythwood Villas, Stroud Green, N.

1898, May 7. NORMAN, ERNEST ARCHIBALD, 65, St. Andrew's Road, Southampton.

1898, May 7. PEARSON, JOHN HENRY, 52, Needham Road, Liverpool.

1898, May 7. *L* PIGGOTT, Miss MAUD ELIZABETH, 148, Castle Hill, Reading.

1898, May 7. *L* PLATT, Miss KATE A., 3, Great James Street, Bedford Row, W.C.

1898, May 7. PORTMAN, WILLIAM CHARLES, 46, Bolina Road, Cliftonville, Bermondsey, S.E.

1898, May 7. POTTER, ALFRED GEORGE, 10, Frant Road, Thornton Heath, Croydon.

1898, May 7. PRATT, JOSEPH JOHN, Hillingdon, near Uxbridge.

1898, May 7. QUELCH, ARTHUR STEPHEN, 136, Walton Street, Oxford.

1898, May 7. REYNOLDS, JOHN HOWELL, 6, Bridge Road, Wellington, Salop.

1898, May 7. ROBERTSON, ALEXANDER MUIR, 1, Ruby Place, Charlton Kings, Cheltenham.

1898, May 7. SANDFORD, EDWARD WILLIAM, 44, Exmouth Road, Gray's, Essex.

1898, May 7. SCOTT, ERNEST EDGAR, 31, Newbury Road, Bromley, Kent.

1898, May 7. *L* STEWART, Miss ETHEL, 3, Princess Road, Regent's Park Road, N. W.

1838, May 7. TAVINER, HERBERT, 16, Denny Road, Lower Edmonton.

1898, May 7. Thomas, Charles Russell, 142*b*, High Street, Lewisham, S.E.
1898, May 7. Toogood, Henry John, Town Hall, Spa Road, Bermondsey, S.E.
1898, May 7. Toogood, Henry Stephen, 56, Buxton Road, Thornton Heath, Croydon.
1898, May 7. *L* Townshend, Mrs. Emily Caroline, 40, York Street Chambers, Bryanston Square, W.
1898, May 7. Tribe, Thomas, Church Road, Farncombe, Godalming.
1898, May 7. Walker, George Simpson, 38, Nottingham Place, W.
1898, May 7. Weeks, George Robert, 45, Tasman Road, Clapham Road, S.W.
1898, May 7. Wells, John, 40, Jessica Road, Wandsworth Common, West Side, S.W.
1898, May 7. West, James, 142, Lillie Road, Fulham, S.W.
1898, May 7. Williams, Thomas William, 32, Barking Road, E.
1898, May 7. Wilson, Charles Northesk, 5, Grittleton Road, Elgin Avenue, Maida Vale, W.
1898, May 7. *L* Wilson, Miss Teresa Frances, 20, Motcomb Street, Belgrave Square, W.
1898, May 7. Worrow, Isaac, 156, High Street, Shadwell, E.

At an Examination in Practical Sanitary Science, held in Leeds on June 10th and 11th, 1898, one Candidate presented himself.

At an Examination for Sanitary Inspectors, held in Leeds on June 10th and 11th, 1898, 36 Candidates presented themselves.

The following 20 Candidates were certified, as regards their Sanitary Knowledge, competent to discharge the duties of Inspectors of Nuisances :—

1898, June 11. Ainley, Edwin, Lower Park, Berry Brow, Huddersfield.
1898, June 11. Bell, John Robert, Suape, Bedale.
1898, June 11. Biker, Tom, Barnoldswick.
1898, June 11. Canby, George Henry, 77, Emily Street, Keighley.
1898, June 11. Carratt, Edwin, 7, Albion Place, Leeds.
1898, June 11. Coupe, James, 4, New Brighton, Bramley, Leeds.
1898, June 11. Cromack, James Samuel, 3, Edgeware Grove, Roundhay Road, Leeds.
1898, June 11. Dalzell, Arthur George, 15, Commercial Street, Halifax.
1898, June 11. Finn, John, Blencowe, Penrith, Cumberland.
1898, June 11. Girven, Frederick William, Pemberton Bank, Easington Lane, R.S.O.

1898, June 11. JACKSON, JOSEPH, 33, Sandgate, Penrith.
1898, June 11. JELFS, WILLIAM THOMAS, Frankley, Birmingham.
1898, June 11. KING, HENRY, 21, Moor Rd., Millom, via Carnforth.
1898, June 11. KING, JOHN WILLIAM, 6, Woodbury St., Blackburn.
1898, June 11. MERRYMAN, AUGUSTUS HENRY, 84, Bridge Street, Castleford, Yorks.
1898, June 11. *L* O'KELL, Miss LIZZIE MARGUERITE, 64, St. Loyes, Bedford.
1898, June 11. SCHOFIELD, ROBERT CLAYBOURN, 77, Emily Street, Lawkholme, Keighley, W. Yorks.
1898, June 11. SCOTT, GEORGE, Jr., Daisy Hill, via Chester-le-Street.
1898, June 11. SIDDALL, GEORGE, Ossett Spa, Ossett.
1898, June 11. WHARFE, ALFRED, 108, Devonshire Street, Keighley.

Examination Questions.

Practical Sanitary Science.—Leeds, June 10th and 11th, 1898.

PAPER I.

1. What is the difference between density and specific gravity? How would you determine the density of a piece of coke?

2. State what is meant by the terms "latent heat," "radient heat," and "convection." How does "convection" differ from "conduction"?

3. Give the composition of a typically good drinking water. State the character and composition you would expect water to have when drawn from the following sources: (*a*) chalk, (*b*) loose sand or gravel, (*c*) upland surface gathering grounds, (*d*) rain.

4. Describe the method you would propose to purify a river water intended for a public supply, and explain its action.

PAPER II.

5. State briefly the precautions to be taken to obtain a stable dry and healthy, building upon the following subsoils:
 a. Stiff clay;
 b. Sand containing springs.

6. At what depth of flow does a drain discharge the greatest volume? Explain why the velocity in a drain running full is no greater than when it is running half-full.

7. What are the advantages and disadvantages of "combined" and "separate" town sewerage systems? and what are the principal considerations that govern a decision as to which system shall be adopted?

8. What is meant by the "flashing point" of petroleum oils? How is this regulated by Act of Parliament? What are the defects in construction of some of the lamps commonly sold that render them dangerous in use?

The Candidates were examined vivâ voce *on the* 11*th*.

Inspector of Nuisances.—Leeds, June 10th and 11th, 1898.

1. Mention the chief diseases which can be recognised on the examination of the dressed carcass of an ox. State how you would deal with the meat exposed for sale in which you recognise any of these diseases.

2. In what way can the following articles best be disinfected: Bedding, books, leather articles, enteric stools? What is the difference between saturated and superheated steam?

3. Give a summary of the provisions of the Public Health Act, 1875, against infection, with respect to premises, disinfecting apparatus, removal of the sick, exposure of infected persons or things, public conveyances, letting of houses, hospitals. State the penalties prescribed for non-compliance with these provisions.

4. Enumerate as many statutory nuisances as you can. What course may be pursued if a nuisance is not abated after due notice?

5. Sketch the arrangements for the drainage of a two-storied house, including water-closets, bath, and sink, and shew the connection between the house drain and the sewer.

6. What is meant by "drain trap"? Describe several forms of trap in use, mentioning their good and their bad points. Illustrate your answer as far as possible by sketches.

7. What is a grease trap? Illustrate by sketches a good form of grease trap; and describe its working and indicate its exact position on a house drainage system.

8. What methods would you propose for the purification of a domestic water supply? Discuss the value of the various filtering media in general use.

The Candidates were examined vivâ voce *on the* 11*th*.

At an Examination in Practical Sanitary Science, held in Belfast on June 24th and 25th, 1898, two Candidates presented themselves, to whom Certificates were granted:—

1898, June 25. GAILEY, THOMAS ANDREW, B.E., B.A., 324, Woodstock Road, Belfast.

1898, June 25. HARGRAVE, WILLIAM HARRISON, Castle Street, Antrim, Ireland.

At an Examination for Sanitary Inspectors, held in Belfast on June 24th and 25th, 1898, 4 Candidates presented themselves.

The following 2 Candidates were certified, as regards their Sanitary Knowledge, competent to discharge the duties of Inspectors of Nuisances:—

1898, June 25. CHRISTIE, WILLIAM CHARLES CRAWFORD, 15, Hamilton Street, Saltcoats, N.B.

1898, June 25. SAYERS, ANDREW, Trosvenor Road, Belfast.

Examination Questions.

Practical Sanitary Science.—Belfast, June 24th & 25th, 1898.

Paper I.

1. What is meant by "Specific Gravity?" How is the "Specific Gravity" of any solid body determined?
2. Sketch and fully explain the principle of the Siphon.
3. What is meant by "Ground Air?" How is its movement influenced? How does it affect the healthiness of a building site, and what steps may be taken to check its entry into a house?
4. State what constitutes a well-constructed open fire-grate, and of what materials it should be made.

Paper II.

5. Describe the manufacture of good bricks, and the composition of lime mortar, cement mortar, and concrete intended for drains and foundations.
6. Describe and sketch a good form of water-closet, with its fittings and connections. What should be the diameter of the supply-pipe, and of the soil pipe, and what quantity of water is necessary to flush it?
7. In sinking a well for the supply of a town, what conditions would determine your selection of a site? What steps would you take to ascertain the quantity of water obtainable?
8. What do you understand by the "Biological" treatment of Sewage? Explain its action.

The Candidates were examined vivâ voce *on the 25th.*

Inspector of Nuisances.—Belfast, June 24th & 25th, 1898.

1. Discuss the relative disinfectant powers of the following agents: dry heat, superheated steam, saturated steam, Condy's fluid, carbolic acid, corrosive sublimate.
2. What is the definition of a cellar dwelling in the Public Health Act, 1875? State the conditions under which it is illegal to occupy an underground room as a dwelling, and name the penalties for breach of the provision of the above Act in this respect.
3. Explain the principles of natural and of artificial ventilation, and show how you would apply each respectively in the case of (1) a cellar dwelling, and (2) an ordinary bedroom.
4. Under what circumstances are certain milk-sellers exempt from "registration"? To what points should you direct your attention when instructed to report upon dairies and upon cowsheds? State the diseases communicable to human beings by cows' milk.

5. Give a sketch plan and section of a Dormitory for twenty persons, showing construction of floor and roof, thickness of walls, and means of warming and ventilation.

6. How would you render the external wall of a building (south-western aspect) damp, rain, and storm proof? Describe the methods usually adopted, and explain why.

7. When inspecting houses, to what points would you direct your attention to ascertain whether the drainage is in proper condition. What are the methods generally employed for testing house drains?

8. What are the comparative advantages of the "dry" and "wet" methods of sewage removal? Describe in detail one system of dry removal.

The Candidates were examined vivâ voce *on the 25th*

FORTHCOMING MEETINGS.

Calendar, July to October, 1898.

As far as at present arranged.

Council Meetings are held Monthly on the Second Wednesday in each Month at 5 p.m., except August and September.

Special Purposes Committee .	. Third Monday at 5 p.m.
Finance Committee . .	. Second Wednesday at 4.30 p.m.
Exhibition Committee . .	. First Tuesday at 5 p.m.
Congress and Editing Committee	. Second Monday at 5.15 p.m.
Museum and Library Committee	. Fourth Monday at 5 p.m.
Parliamentary Committee .	. As occasion requires.
Rivers Pollution Committee .	. As occasion requires.

JULY.

8 F. }
9 S. } Examinations in Practical Sanitary Science and for Inspectors of Nuisances, Cardiff.

29 F. }
30 S. } Examinations in Practical Sanitary Science and for Inspectors of Nuisances, Liverpool.

SEPTEMBER.

27 T. **The Seventeenth Congress and Health Exhibition opens at Birmingham.** *(Programme is given in Appendix facing page 336.*

OCTOBER.

The TWENTY-SIXTH COURSE of LECTURES and DEMONSTRATIONS for Sanitary Officers will commence on MONDAY, OCTOBER 17th.

FELLOWS, MEMBERS & ASSOCIATES ELECTED

From April to June, 1898, inclusive.

(A complete list can be had on application.)

FELLOWS.

† Passed Examination as Local Surveyor.

54 1898. Apr. †Berrington, Richard Evans Willoughby, assoc.m.inst.c.e., *Graiseley, Wolverhampton.*

926 1898. June. Roechling, Herman Alfred, assoc.m inst.c.e., f.g.s., 14, *Market Street, Leicester.*

924 1898. Apr. Spinks, W., assoc.m.inst.c.e., *Prudential Buildings, Leeds.*

971 1898. Apr. Willcox, J. E., assoc.m.inst.c.e., *Union Chambers,* 63, *Temple Row, Birmingham.*

MEMBERS.

* Passed Examination in Practical Sanitary Science.

‡ Passed Examination as Inspector of Nuisances.

Reg. No. Date of Election.

1167 1898. May. Burford, Samuel Francis, *Analyst, Eastleigh, Queen's Road, Leicester.*

1188 1898. May. Egerton of Tatton, Lord, 7, *St. James' Square, S.W.*

1193 1898. June. Farnham, William Augustus, f.a.s.i., 16, *Arneway Street, S.W.*

1189 1898. May. Galsworthy, Sir Edwin Henry, j.p., d.l., 26, *Sussex Place, Regent's Park, N.W.*

1194 1898. June. Garrett, Henry Augustus, assoc.m.inst.c.e., Boro' Surveyor and Harbour Engineer, *Town Hall, Torquay.*

1190 1898. May. Hartley, Thomas Haighten, *Borough Engineer and Surveyor, Colne, Lancs*

1195 1898. June. Kieser, William Henry Gustave, f.a.s.i., stud. inst.c.e., *Assistant Borough Surveyor, Town Hall, Torquay.*

1191 1898. May. Logier, Eugene Adolphe, assoc.m.inst.c.e., *Glendalough, Ballyholme Road, Bangor, Co. Down.*

1196 1898. June. ‡Matthews, Ernest Romney, *Borough Engineers' Department, Town Hall, Hastings.*

1197 1898. June. Mellis, John Charles, m.inst.c.e., f.g.s., *Gresham House, Old Broad Street, E.C.*

1163 1898. Apr. Nall, J., b.a.camb., d.p.h.camb., m.r.c.s.eng., l.s.a., *Whaley Bridge, Nr. Stockport.*

1198 1898. June. Newton, Ernest Bennett Brierley, 131, *Monton Road, Eccles.*

1199 1898. June. *Page, Stanley Hatch, f.s.i., 1, *Harbour St., Ramsgate.*

1200 1898. June. Parr, Thomas Henry Nowell, *Engineer and Surveyor to the Brentford U.D.C., Brentford, Middlesex.*

1194 1898. Apr. PRITCHARD, T., ASSOC.M.INST.C.E., 264, *Gresham House, Old Broad Street, E.C.*
1192 1898. May. *QUICK, Edward Hare, *Laureldale, Lympstone, Devon.*
1195 1898. Apr. SLATER, J., ASSOC.M.INST.C.E., *County Dist. Surveyor for the Salford Hundred, Eccles Old Road, Pendleton.*
1201 1898. June. WALTON, Rienzi Giesman, M.INST.C.E., 32, *Hogarth Road, Kensington, W.*
1202 1898. June. ‡WESTWICK, Louis Alfred, 43, *Leeming St., Mansfield.*
1196 1898. Apr. WILKINSON, Jas. B., M.D., C.M., D.P.H., M.O.H., *Westwood House, Oldham.*
1203 1898. June. WILSON, H. McLean, M.D., B. SC. (PUB. HEALTH), *Blenheim Road, Wakefield.*
1204 1898. June. *WOODS, Walter Harry, 9, *Derby Road, Long Eaton, near Nottingham.*

ASSOCIATES.

‡ Passed Examination as Inspector of Nuisances.

1727 1898. Apr. ‡ANDERSON, J. G., *Public Offices, Wakefield Street, East Ham.*
1728 1898. Apr. ‡BAILEY, W. G., *Failsworth, Manchester.*
1750 1898. June. ‡BARNES, William, *Corn Street, Witney.*
1751 1898. June. ‡BIRD, Guelph John, *Heath Street, Victoria Road, Tamworth.*
1743 1898. May. ‡COLES, William George, 6, *Devonia Terrace, Alphington, Exeter, Devon.*
1729 1898. Apr. ‡CRAIG, John, 6, *Bryntirion Street, Dowlais, Glam.*
1752 1898. June. ‡CRAVEN, Walter, *Devonia, St. Saviour's Road, Bath.*
1753 1898. June. ‡DAVIES, Miss Edith Emma Richards, *Nurses' Home, Howard's Road, Plaistow, E.*
1730 1898. Apr. ‡GILFEATHER, J. 18, *Church Street, Maxwelltown, Dumfries.*
1731 1898. Apr. ‡GREENUP, H., 22, *Clarence Road, Chorlton-cum-Hardy.*
1732 1898. Apr. ‡HAMILTON, B. W., 12, *Tregothnan Road, Stockwell.*
1733 1898. Apr. ‡HARDY, John William, 46, *Mersey Street, Holderness Road, Hull.*
1734 1898. Apr. ‡HOPKINSON, Frederick, *Poplar House, Watson Road, Worksop.*
1736 1898. Apr. ‡JONES, Edwin W., 108, *Bloomfield Road, Tipton.*
1754 1898. June. ‡JONES, Thomas, 10, *Hawarden Crescent, Swansea.*
1744 1898. May. ‡KAIN, Frederick William, 3, *St. Nicholas Road, Sutton, Surrey.*
1737 1898. Apr. ‡LYNE, Jabez, 27, *Glenavon Road, Stratford, E.*
1735 1898. Apr. ‡MACQUEEN, Andrew Stewart, 41, *High Street, Linlithgow, N.B.*
1738 1898. Apr. ‡McCLEMENT, John, *Clerk of Works, Springfield, Inverness.*
1755 1898. June. ‡MELHUISH, Frank W., *Health Department, Sydney, Australia.*

1736 1898. June. ‡MERRIFIELD, Frederick, *Park Road, Sutton Coldfield.*
1745 1898. May. ‡METCALFE, Richard Moore, 31, *Claret Street, Accrington, Lancashire.*
1737 1898. June. ‡NEVILE, Miss Catherine A., 3, *Blythwood Villas, Stroud Green, N.*
1739 1898. Apr. RAVENHILL, Miss A., 3, *Cleveland Gardens, Ealing.*
1740 1898. Apr. ‡ROGERS, Frederick, 8, *Kilnhurst Road, Todmorden.*
1746 1898. May. ‡ROGERS, Richard Alfred, *Newton Abbot, Devon.*
1747 1898. May. ‡SHAW, John William, 1, *Abbey Road, Grimsby, Lincolnshire.*
1741 1898. Apr. ‡SIMMONS, Richard, *Porthcawl, Glam.*
748 1898. May. ‡SPEARS, Ernest Godwin, *Woodhurst, Wellington Road, Handsworth, Staffs.*
749 1898. May. ‡THORPE, Frank B., 4, *Alexander Place, Selhurst, S.E.*
742 1898. Apr. ‡WHITE, Miss A. N., 4, *Warwick Terrace, Leeson Park, Dublin.*
738 1898. June. ‡WILLIAMS, William, 44, *Wyndham Street, Treherbert, Glam.*
739 1898. June. ‡WILSON, Charles Northesk, 8, *Frobisher Terrace, Falmouth.*

OBITUARY.

SIR ROBERT RAWLINSON, K.C.B., M.INST.C.E.
(VICE-PRESIDENT.)

By the death of Sir Robert Rawlinson we have lost another of the pioneers of modern practical Sanitary Science.

Robert Rawlinson was born in Bristol on the 28th February, 1810, being the son of a mason and builder carrying on business in Lancashire. He began his career as a working stonemason. One of his first engagements was with Jesse Hartley, the famous Engineer of the Liverpool Docks, whose office he entered at the age of twenty-one as a measurer of masonry. But his abilities soon advanced him to more important duties, and in 1836 we find him in the service of Robert Stephenson, acting as Assistant Resident Engineer on that difficult section of the London and North-Western main line at the Roade cutting, where the alternate layers of limestone and clay caused so much trouble to all concerned in the construction of the railway.

In 1840 he returned to Liverpool as Assistant Surveyor to the Corporation, in which post his attention was turned from Civil Engineering proper to Sanitary Engineering, and to the promotion of healthy conditions of existence among the dense populations of our larger towns. In 1846 he put forward a proposal to supply Manchester and Liverpool with water brought

by an aqueduct from Lake Bala, but the scheme was in advance of the times, and was rejected on the ground of expense.

Sir Robert Rawlinson was, however, averse to vast schemes of water supply, and in his Presidential Address to the Civil Engineers he distinctly expressed himself against any attempt to bring water from North Wales to provide a supply for London.

At the commencement of the Queen's reign attention had begun to be directed to the condition of the labouring classes. The peace which had succeeded to the Napoleonic wars had led to a rapid development of our industries; the consequent result was a large influx of population into the various manufacturing centres, without much regard being paid to any of those necessities of healthy life which are now looked upon as an essential feature of our civilization.

An epidemic of cholera directed the attention of the Government to the unsatisfactory condition of the working classes. A Royal Commission of Inquiry was appointed, and their masterly Report, drawn up chiefly by Sir Edwin Chadwick, exposed the prevalent evils of agglomerated populations. This was followed by the Health of Towns Commission, and the passing of the Public Health Act of 1848.

The Commissioners of Public Health selected the rising Engineer, Robert Rawlinson, to be one of their Inspectors, and in that capacity he visited and inspected numbers of towns all over the country; and the reports in which he exposed the overcrowding, the lack of drains and sewers, the absence of a wholesome water supply, and the general want of cleanliness which he found in only too many places, were not pleasant reading for the municipal authorities, whose resentment was sometimes shown by forcible abuse of the man and active opposition to the remedies he prescribed.

Chadwick had been a great advocate of the water-carriage system for liquid and domestic refuse, and Rawlinson showed the importance of making special drains to carry away the sewage, which was a constant quantity, so as to separate it from the rainfall, which was variable; and in the towns such as Alnwick—which he sewered upon the separate principle—he utilized the sewage by applying it on land. After the breaking up of the Board of Health he acted as Advisory Engineer to the Privy Council, and on the formation of the Local Government Board he became Chief Engineering Inspector of that Department, which office he held for sixteen years. In that capacity he to a great extent devised and largely controlled the sanitary methods upon which the drainage and water supply of the various towns in England, exclusive of London have been moulded. It is scarcely too much to say that Rawlinson was

the chief mover in devising the principal features of the modern school of drainage for towns. It is not, however, in that capacity only that he was able to afford valuable assistance to the State. His services were sought by the Government to remedy the sanitary disasters in the Crimean War. Florence Nightingale—who had gone to Constantinople in October, 1854, with a large detachment of nurses to nurse the wounded and sick soldiers from the Crimea—found the large buildings at Scutari which were allotted as Hospitals in such a disgraceful condition, that of the sick and wounded about one out of every two who came to the hospital died.

Miss Nightingale made strong appeals to the home authorities for a Sanitary Engineer to be sent out to execute the structural works necessary to place the hospitals in a healthy state. Meanwhile, towards the end of 1854, the sickness and mortality among our soldiers encamped before Sevastopool had become truly appalling. On December 23rd *The Times* wrote, that "the noblest Army England ever sent from these shores has been sacrificed to the grossest mismanagement," and that "incompetency, lethargy, aristocratic hauteur, official indifference, favour, routine perverseness, and stupidity, reign, revel, and riot in the camp before Sevastopool, in the harbour of Balaclava, in the hospitals of Scutari." Early in the next year popular indignation drove the Ministry from office, and Lord Palmerston, who became head of the Government, was obliged to adopt prompt and vigorous measures to improve the condition of our troops in the East. Among these was the sending out of a Sanitary Commission composed of Dr. Sutherland, Dr. H. Gavin, and Mr. Rawlinson. The instructions under which these gentlemen acted were perhaps the most remarkable that have ever been issued from the War Office. For once the solemn forms of red tape and precedent were brushed aside, and not only were the Commissioners instructed to use the utmost expedition in examining into the causes of, and finding remedies for, the unhealthy state of camp and hospital, but were ordered to see, either personally or through their agents, that works considered necessary were immediately begun, and to superintend their progress day by day until they were finished. However unusual may have been the tone of these instructions, they were at least justified by results. The Commission reached Constantinople in the beginning of March, and set to work on the Levantine hospitals. Here, in Kinglake's words, a few weeks effected "a change which, if only it had been preceded by mummery instead of by ventilation and drainage, would have easily passed as a miracle," and the death-rate fell from nearly 50 per cent. in February, to about 2½

at the end of June. In the Crimea, which the Commissioners reached in April, similar happy results were soon obtained, simply by having ordinary regard for such matters as lime-washing, ventilation, scavenging, and uncontaminated water supply; so that by the end of 1855 the whole Army in the field before Sevastopool was in better health than it had ever been at home.

The lesson afforded by these results in sanitation was not thrown away, and increased attention to sanitary requirements has since 1858 effected a very great reduction in the annual mortality of the British Army.

Sir Robert Rawlinson was appointed a member of the Army Sanitary Committee, and continued to afford his assistance to the sanitary improvement of the Army, both at home and in India, until his retirement a few years ago.

In 1863, the American Civil War, by stopping the supply of raw material, produced wide-spread distress in the cotton manufacturing districts of Lancashire, depriving many thousands of operatives of their means of livelihood. The liberality of the public contributed large sums to alleviate the consequent misery, and the Government passed the Union Rate in Aid Act in modification of the existing poor laws. But, efficient as were these measures of relief up to a certain point, it was soon felt that the long-continued distribution of doles was attended with grave disadvantages to the recipients. Hence in the spring of 1863 the idea orginated in the affected districts that the Government should start works of "utility, profit, and ornament," in order to provide employment at a fair wage for the starving workers. The proposal was kindly received, and at the end of April the Home Secretary despatched Mr. Rawlinson and Mr. Farnell to Lancashire to enquire into its feasibility. After visiting and inspecting over ninety of the principal places, Mr. Rawlinson reported that, in his opinion a million and a half sterling might be expended in permanent improvements of a beneficial character, such as main sewerage, drainage, forming and completing streets, making new water-reservoirs, and laying out parks and recreation grounds, and in consequence of his statements the Commissioners of the Treasury were promptly authorized to advance out of the Consolidated Fund a sum not exceeding £1,200,000 at 3½ per cent. on the security of the local rates, to facilitate the execution of the public works suggested. Under Mr. Rawlinson's direction success attended the experiment; the men were employed at a wage not less than 12s. a week, and the fact that they had something to do instead of loafing idly round the doors of their houses exercised a wholesome influence on their health and

spirits. How advantageous were the works to the districts in which they were carried out may be judged from Mr. Rawlinson's computation, that if all the streets and roads in Lancashire that were at this time sewered, drained, paved, and generally improved were added end to end they would form a roadway 400 miles long. In this way £1,850,000 in all were spent, and in recognition of the services he rendered, Mr. Rawlinson was made a C.B. Upon his retirement from the Local Government Board in 1888 he was promoted to be a K.C.B., having already been knighted in 1883.

In addition to his official duties he acted as Chairman of the Royal Commission on the Pollution of Rivers in 1866, and he served on the Commission which inquired into the sanitary condition of Dublin in 1879.

He also held enquiries on the pollution of the river Thames, and on the mud bank formed by the sewer outfall at Barking.

Sir Robert Rawlinson was a Vice-President of the Sanitary Institute and Parkes Museum since 1883. He was President of the Congress held by the Institute in Dublin in 1884. He contributed several papers relating to Army Hygiene to the Institute, and frequently attended and presided at its meetings.

With all those who, like the writer of this article, had the pleasure of the acquaintance of Sir Robert Rawlinson, he has left the memory not only of a man of high intellect and of extreme industry and conscientious devotion to his profession, but that of a most amiable and sympathetic friend. D. G.

EXHIBITS ADDED TO THE MUSEUM.

MARCH TO JUNE, 1898.

Tape Worm. Tænia mediocanellata.

Diseased Pork. Specimen of Disease called "Diamonds."

Stone Drain. Spigot and socket ends of a 9-inch stone drain taken from an old house in St. James' Square. *T. W. Calverley.*

Sedimentary Matter, from a London Sewer, including road detritus, stones, cinders, glass bottles, scrubbing brush, broken crockery, &c.

Flushing Cistern. "The Eveflus" Water Waste Preventer. *Evered & Co., Ltd.*

Soil Pipe (Model, full size). Comprising a Lead Soil-pipe 3½ inches diameter, and Ventilating Shaft, each 32 feet in height, to which are connected two branches fitted to receive either valve or wash-down Closets. The top of the soil-pipe and the anti-siphonage pipe are fitted with valves which can be opened or shut, and the traps under the closets are fitted with glass panels to show the result of flushing under various conditions. *Constructed for the Committee.*

CONTRIBUTIONS AND ADDITIONS TO LIBRARY

MARCH TO JUNE, 1898.

*** *For publication of Societies and Institutions, &c., see under "Academies."*

ACADEMIES (AMERICAN).

Philadelphia. *College of Physicians of.* Transactions, Series, Vol. XIX. 351 pp., 8vo. Philadelphia, 1897. *The College.*

ACADEMIES (BRITISH).

London. *British Association for the Advancement of Science.* Report of the Sixty-seventh Meeting, held at Toronto, August, 1897. 1019 pp., 8vo. London, 1898. *The Association.*

——— *Institute of Chemistry of Great Britain and Ireland.* Proceedings, Part I., 1898. 41 pp., 8vo. London, 1898. *The Institute.*

——— *Institution of Civil Engineers.* Minutes of Proceedings, Vol. XXV.—XXXVIII., 1872-74; XL., Part II.—XLIII., Part I., 1874-76; XLV., Part III.—XLVII., Part I., 1875-77. Vol. XLVIII., Part II. (incomplete)—L., Part IV., 1876-77; LII., Part II.—LIV., Part IV., 1877-78; Name Index, Vol. L. to LVIII., 489 pp. 8vo. London. *J. Wallace Peggs, Assoc.M.Inst.C.E.*

——— *Middlesex Hospital.* Reports of the Medical, Surgical, and Pathological Registrars for the Year 1896. 354 pp., 8vo. London, 1897. *The Hospital.*

——— *Society of Engineers.* Transactions for 1897 and general Index 1857 to 1897. 236 pp., 8vo. London, 1898. *The Society.*

——— *The Institution of Civil Engineers.* Minutes of Proceedings, with other selected and abstracted papers. Vol. XXXI., Part I., 1897—98. 500 pp., 8vo. London, 1898. *The Institution.*

Newcastle-upon-Tyne. *North of England Institute of Mining and Mechanical Engineers.* Transactions, Vol. XLVI., Part VI.: Part II., 8vo., Newcastle, 1898. An account of the Strata of Northumberland and Durham, as proved by Borings and Sinking U.Z. 238 pp., 8vo. Newcastle, 1897. *The Institute.*

Adler, *Rev. Dr.* Sanitation as taught by the Mosaic Law. 12 pp., 8vo. London, 1893. *Rev. F. Lawrence.*

Army Medical Department. Report for the year 1896, with Appendix. Vol. XXXVIII. 485 pp., 8vo. London, 1897. *Director-General J. Jameson.*

Balfour, *David, M.Inst.C.E.* Purification of Sewage. 10 pp., 8vo. Journal of Newcastle Farmers' Club, 1898. *The Author.*

Board of Agriculture. Annual Reports of Proceedings under the Diseases of Animals Acts, the Markets and Fairs (Weighing of Cattle) Acts, &c., &c., for the year 1897. 136 pp., 8vo. London, 1897. *The Board.*

Bombay. Thirty-Second and Thirty-Third Annual Reports of the Sanitary Commissioner for the Government of Bombay, 1895 and 1896, with Appendices. F.cap. Bombay, 1896, 1897. *Surg.-Lieut.-Col. J. W. Clarkson.*

Boulnois, *H. Percy, M.Inst.C.E.* The Municipal and Sanitary Engineer's Handbook. 3rd Edition, 474 pp., 8vo. E. and F. N. Spon. London, 1898. *The Author.*

Canada. *Laboratory of the Inland Revenue Department, Ottawa.* Bulletin No. 54, Condensed Milk, No. 55. Fertilisers. 8vo., 1897. *T. Macfarlane, Chief Analyst.*

Coni, *Dr. E. R.* Les Progrés de l'Hygiène publique dans la République Argentine. 56 pp., 8vo. Paris, 1891. *Mrs. Topley.*

De Rance, *C. E., Assoc.M.Inst.C.E.* Hydro-Geology and Hygiene—Law and Legislature. 22 pp., 8vo. July, 1896. *The Author.*

"Engineer," *An.* The Theory and Practice of Warming and Ventilating Public Buildings, Dwelling Houses, Conservatories, &c., &c. 340 pp., 8vo. London, 1825. *Mrs. Topley.*

Fosbroke, *G. H., D.P.H.* Report to Sanitary Committee of Worcestershire County Council on Bacteriological Filters for Sewage Disposal. 17 pp., 8vo. Worcester, 1898. *Sir Douglas Galton, K.C.B., F.R.S.*

General Board of Health. Minutes of information collected with reference to works for Removal of Soil-water or Drainage of Dwelling Houses and public edifices, and for the Sewerage and cleansing of the sites of towns. 207 pp., 8vo. London, 1852. *Mrs. Topley.*

Gerhard, *William Paul.* Sanitary Engineering. 132 pp., 8vo. New York, 1898. *The Author.*

Glasgow. *City Fever and Small-pox Hospitals.* Reports for the Years ending May 31st, 1896 and 1897, by A. Johnston, M.D., D.P.H. 8vo. Glasgow, 1896—1897. *The Author.*

Hastings. Two Reports on the Water Supply of, by Sanitary Commissions of the *Medical Times and Gazette* and the *Lancet.* 18 pp., 8vo. St. Leonards, 1876. *Mrs. Topley.*

Haviland, *Alfred, M.R.C.S.* Inaugural Address on Medical Geography as an aid to Clinical Medicine. 20 pp., 8vo. Bale & Son, price 1s. London, 1897. *The Author.*

Hawkins, *C. E.* Formulæ relating to Egg-shaped Sewers. 4 pp., 8vo. London. *Mrs. Topley.*

Heaton, *Prof. C. W., F.C.S.* The Future Water Supply of London. 20 pp., 8vo. Excerpt *Quarterly Journal of Science*, 1896. *W. Whitaker, B.A., F.R.S.*

Holland, *Henry, M.D., F.R.S.* Medical Notes and Reflections. 2nd Edit. 638 pp., 8vo. London, 1840. *Bushell Anningson, M.A., M.D.*

Hovent, *Dr.* Asthme, Bronchites Emphysème pulmonaire et maladies chroniques diverses—leur traitement aérsthérapique. 56 pp., 8vo. Bruxelles, 1898. *The Author.*

Local Government Board. Dr. Theodore Thomson's Report on Epidemic Measles in the Borough of Lancaster. 11 pp., f.cap. London, 1898. *Sir Richard Thorne, K.C.B., F.R.S.*

Local Government Board. Dr. W. W. E. Fletcher's Report on Prevalence of Diphtheria in Chipping Norton Rural District. 6 pp., fcp.. London, 1898.

——— Dr. W. W. E. Fletcher's Report on Recent Prevalence of Diphtheria in Worcester, and on the Sanitary circumstances and administration of the City. 15 pp., f.cap. London, 1898.

——— Dr. R. Bruce Low's Report on the sources and circumstances of the Public Water Service provided by the Bury Corporation for the supply of the County Borough of Bury and certain neighbouring Districts. 12 pp. London, 1898.

——— Dr. Buchanan's Report upon the occurrence of certain cases of Enteric Fever in six Sanitary Districts of Essex and Suffolk, and upon Oysters in relation thereto. 15 pp. London, 1898. *Sir Richard Thorne, K.C.B., F.R.S.*

Mansion House Council on the Dwellings of the Poor. Report for the Year ending December 31st, 1897. 70 pp., 8vo. London, 1898. *J. Hamer, J.P.*

Massachusetts State Board of Health. Report on Cerebro-spinal Meningitis and its relation to other forms of Meningitis. 178 pp., 8vo. Boston, 1898. *The Board.*

MEDICAL OFFICERS OF HEALTH AND OTHER SANITARY REPORTS.

Ashwell (**Rural**), 1897 ..	*Bushell Anningson, M.A., M.D.*
Aylesbury, 1897	*C. Hooper, M.R.C.S.*
Basford R.D.C., 1897 ..	*G. B. Wray, M.R.C.S., D.P.H.*
Batley (**San. Insp.**), 1897 ..	*J. Lindley.*
Calcutta, 1896	*W. J. Simpson, M.D.*
Cambridge, 1897	*Bushell Anningson, M.A., M.D.*
Cheltenham, 1897	*J. H. Garrett, M.D.*
Chesterton (**Urban**), 1897 ..	*Bushell Anningson, M.A., M.D.*
„ (**Rural**), 1897 ..	*Bushell Anningson, M.A., M.D.*
Chingford, 1897	*S. T. Taylor, M.B.*
Darwen, 1897	*F. G. Haworth, M.B., D.P.H.*
Dublin, 1897	*Sir C. A. Cameron, M.D.*
Eccles, 1897	*J. H. Crocker, M.D., D.P.H.*
Ely (**Rural**), 1897	*Bushell Anningson, M.A., M.D.*
Exeter, 1897	*John Woodman, M.D., F.R.C.S.*
Gibraltar, 1897	*Surg.-Maj. H. P. G. Elkington, D.P.H.*
Harrow, 1897	*J. Fletcher Little, M.B.*
Hastings, 1897	*The Town Clerk.*
Huddersfield. 1st Quarter, 1898	*E. G. Annis, M.R.C.S., D.P.H.*
Liverpool, 1897	*E. W. Hope, M.D., D.Sc.*
London County Council, 1892—96	*Shirley F. Murphy, M.R.C.S.*
London, Port of, Half-year to December 31st, 1897 ..	*W. Collingridge, M.A., M.D.*

rn (Rural), 1897 ..	*Bushell Anningson, M.A., M.D.*
stle-upon-Tyne, 1897 .	*H. E. Armstrong, D.Hy., M.R.C.S.*
'indsor, 1897	*E. Casey, M.D.*
h, 1897	*H. Cooper Pattin, M.A., M.B.*
m, 1897	*J. Crathon.*
, 1897	*W. L. Hunter, B.A., M.D., D.P.H.*
la, 1897	*Herbert Jones, D.P.H.*
'yne Port, 1897 ..	*W. E. Harker, M.D.*
gh C.C., (San. Insp.)	*Adam Morris.*
n, 1897	*Bushell Anningson, M.A., M.D.*
s (Hunts) and Swave-Rural), 1897	*Bushell Anningson, M.A., M.D.*
rgaret and St. John, minster, 1897 ..	*John Norton, M.D., D.P.H.*
ry, Stoke Newington, ...	*Henry Kenwood, M.B., D.P.H.*
ort, 1897	*H. H. Vernon, M.D., F.R.S.Edin.*
C.C., 1897	*E. C. Seaton, M.D., F.R.C.P.*
y, 1897	*P. Q. Karkeek, M.R.C.S.*
Bromwich, 1897 ..	*Herbert Manley, M.A., M.B., D.P.H.*
ancashire R.D.C., 1897	*Herbert Peck, M.B., D.P.H.*
hapel, 1897	*J. Loane, M.R.C.P., D.P.H.*
1897	*Wm. Berry, F.R.C.S.I., D.P.H.*

---

and Irwell Joint Committee. Report by R. A. Tatton, st.C.E., February, 1898. 19 pp. (Tables), 8vo. Manchester, . *The Author.*

ux, *W., F.G.S.* The Conservancy of Rivers. 27 pp., 8vo. on-on-Trent, 1879. *Mrs. Topley.*

s, *G. L., M.A., M.D.* Tuberculosis and the Public Health. p., 16mo. Sydney, 1898. *The Author.*

ersey State Board of Health. Twenty-First Annual Report, the Report of the Bureau of Statistics, 1897. 389 pp., 8vo. ton, N. J., 1898. *The Board.*

olme, *Arthur, M.D., M.R.C.P.* Epidemic Diphtheria: a re-h on the origin and spread of the disease from an international lpoint. 196 pp., 8vo. London, 1898. *Purchased.*

ork. Report of the Department of Street Cleaning for 1895-7, by George E. Waring, Jun., Commissioner. 234 pp., 8vo. York, 1898. *The Author.*

gham Corporation. Report of Deputation from Health Com-e of, after their inspection of certain knackery and abattoir ings and plant in Germany. 15 pp., 8vo. November, 1897. *W. Whitaker, B.A., F.R.S.*

rg, *Dr. Albert.* Contribution a la Géographie de la Tubercu-Phthisie Pulmonaire en Finlande. 33 pp., 8vo. Helsingfors, *The Author.*

Paris. Annales des Ponts et Chaussées. 1re Partie. Mémoires et Documents relatifs à l'art des constructions et au service de l'Ingénieur. 1897. 4e trimestre. 389 pp., 8vo. Paris, 1898. *L'Inspecteur-général Secrétaire de la Commission.*

Patent Office. Abridgments of Specifications, period 1889—92. Class 1, Acids, Alkalis, &c. 2, Acids and Salts, Organic. 10, Animal Power Engines and Miscellaneous Motors. 11, Artists' Instruments. 12, Bearings and Lubricating Apparatus. 14, Beverages. 16, Books. 18, Boxes and Cases. 19, Brushing and Sweeping. 25, Chimneys and Flues. 29, Cooling and Ice-making. 31, Cutting and Perforating Paper, &c. 35, Dynamo-Electric Generators, &c. 36, Electricity. 39, Electric Lamps and Furnaces. 45, Fencing, &c. [illegible] Fire Extinction. 53, Galvanic Batteries. 57, Governors fo[illegible]gines, &c. 59, Grinding, &c. 62, Harness, &c. 63, Hats a[illegible]er Head Coverings 67, Horse Shoes. 71, Injectors and E[illegible]. 76, Leather. 84, Milking, Churning, and Cheesemaki[illegible] Mixing Machines. 88, Music and Musical Instruments. [illegible]-Metallic Elements. 92, Ordnance and Machine Guns. [illegible] Paper, Pasteboard, &c. 100, Letterpress Printing, &c. 12[illegible]rch, Gum, and other adhesive Materials. 139, Watches, Clocks, &c. 144, Wheels and Vehicles. 4to. London, 1898. *H.M. Patent Office.*

Public Health (Scotland) Act, 1897. 92 pp., 8vo. Price 10d. *Purchased.*

Registrar-General, England. Fifty-Ninth Annual Report of Births, Deaths, and Marriages in England, 1896. 296 pp., 8vo. London, 1897. *The Registrar-General.*

Rome. Annali d'Igiene Sperimentale e diretti dal Prof. Angelo Celli. Vol. VII. (Nuova Serie). 1897. 475 pp., 8vo. Roma, 1897. *Prof. A. Celli.*

Romeril, *W. G.* Sanitation in the British Mercantile Marine. 63 pp., 8vo. Shipping World Co. London, 1896. *The Author.*

Royal Commission on Tuberculosis. Report of, appointed to inquire into the administrative procedures for controlling danger to man through the use as food of the meat and milk of Tuberculous Animals. Part I., 27 pp., fcap. Eyre & Spottiswoode, Price 3d. London, 1898. *Purchased.*

Royal Commission on Water Supply. Report of the Commissioners. 128 pp., fcap. London, 1869. *Mrs. Topley.*

Southport Convalescent Hospital. Annual Report, 1897. 66 pp., 8vo. *A. Smith.*

Southport Meteorology Department, *Fernley Observatory.* Report and Results of Observations for the year 1897, by Joseph Baxendell, F.R.Met.Soc. 29 pp., 4to. Southport, 1898. *The Author.*

Sutcliffe, *G. Lister, A.R.I.B.A.* The Disposal of Refuse from the City of London, with Appendices on Refuse Destruction at Hereford, and the Shoreditch Destructor. 37 pp., 8vo. Reprint from *Public Health Engineer.* Hodgetts, Ltd. London, 1896. *The Author.*

Switzerland. Rapport du Bureau Fédéral des Assurances sur les Enterprises Privées en Matière d'Assurances en Suisse en 1896. 224 pp., 4to. Berne, 1898. *Bureau de Statistique.*

—— Statistique de la Suisse. Mouvement de la Population, pendant l'année 1896. 33 pp., 4to. Berne, 1898. *Bureau de Statistique.*

Symons, *G. J., F.R.S.*, and **Wallis,** *H. Sowerby, F. R. Met.Soc.* Symons' British Rainfall on the Distribution of Rain over the British Isles during the year 1896, as observed at more than 3000 stations in Gt. Britain and Scotland, with articles upon various branches of Rainfall work, 1893-96 (4 vols.) 8vo. London, 1894-97. *G. J. Symons, F.R.S.*

Thompson, *J. Ashburton, M.D., D.P.H.* Leprosy in Hawaii: a critical enquiry. 40 pp., 8vo. Sydney, 1898. *The Author.*

Tommassi-Crudelli, *Corrado.* Della distribuzione delle acque nel sottosuolo dell' agro romano e della sua influenza nella produzione della malaria. 15 pp., 4to. Roma, 1879. *Mrs. Topley.*

United States. Report on the Vital and Social Statistics in, at the Eleventh Census, 1890. Part I., Analysis and Rate Tables. 1059 pp., 4to. Washington, 1896. *Prof. W. H. Corfield, M.A., M.D.Oxon.*

Waring, *G. E. Jun., M.Inst.C.E.* Street Cleaning and the Disposal of a City's Wastes: Methods and Results and the Effect upon Public Health, Public Morals, and the Municipal Prosperity. 230 pp., 8vo. London, 1898. Gay & Bird. *The Publishers.*

—— The Purification of Sewage by Bacterial Oxidation: a Study of the Natural Processes of Filth Removal, and of the means by which their efficiency may be artificially intensified. 28 pp. Charlotte, N.C. *D. A. Tompkins & Co.*

Whitaker, *W., B.A., F.R.S.* Some Middlesex Well Sections. 35 pp., 8vo. Excerpt from Transactions of the British Association of Waterworks' Engineers. *The Author.*

Woodhead, *G. Sims, M.D., F.R.S.E.*, and **Wood,** *G. E. Cartwright, M.D., B.Sc.* An Inquiry into the Relative Efficiency of Water Filters in the Prevention of Infectious Diseases. 135 pp., 8vo. British Medical Association. London, 1898. *Purchased.*

Zucchi, *Dr. Carlo.* La Reforma Sanitaria in Italia. 336 pp., 8vo. Milano, 1888. *Mrs. Topley.*

NOTES ON LEGISLATION AND LAW CASES.

Prepared by Dr. H. Manley, M.O.H., West Bromwich.

THE ENFORCEMENT OF SPECIAL SANITARY CONVENIENCES.

MAYOR, ETC., OF BRADFORD *v.* HOLDSWORTH.

This case was heard at the Bradford City Police Court, on April 28th last, when the Stipendiary reserved his decision. The De-

fendant was summoned under Sec. 21 of the Bradford Improvement Act, 1873, for not providing water-closet accommodation at certain houses owned by him in lieu of defective privies. Section 21 of the Improvement Act provides:—

"In addition to all powers vested in the Corporation, the Corporation may in any case where a dwelling-house within the borough shall be without a privy, water-closet, or earth-closet, or an ashpit, or without a privy, water-closet, or earth-closet, or an ashpit of a construction and size approved by the Corporation, require the owner of such house, by notice, under the hand of the Mayor or Town Clerk for the time being, to provide such a privy, water-closet, or earth-closet, or such an ashpit, or to make such reparation or alteration of the existing privy, water-closet, or earth-closet, or ashpit, as in such notice shall be stated, and within a period to be therein mentioned. If such owner shall neglect to comply with such notice within the time therein appointed, he shall for every such offence forfeit a sum not exceeding five pounds, and a further penalty not exceeding the like sum for every day during which such offence shall continue."

The houses (Nos. 106 to 116, Isles Street) were erected in 1873 in accordance with plans approved by the Corporation. In 1892 the Corporation decided that no new privies should be erected in the borough, but that water-closet accommodation should be provided. It was admitted, that if the privies at these houses had been kept in good repair no action would have been taken. Notices under the 21st section were served in December last, after which the privies were put into good repair. It was contended by the Corporation that the Defendant had no option in the matter, but must provide water-closets as required by the notice of December.

The STIPENDIARY gave judgment on May 9th as follows:—

The point in question was as to the extent of the power of the Bradford Corporation in regard to the construction of sanitary conveniences, and in this instance it related to privies and ashpits belonging to the Defendant at Nos. 106 to 116, Isles Street. A Sub-inspector reported on November 23rd that these privies and ashpits were in a foul and dilapidated condition, and the Corporation issued notices under the 21st Section of their Act requiring the construction of water-closets. The Defendant did not construct water-closets, but put the existing conveniences into such state of repair that it was admitted by Mr. Chambers, the Head Inspector, that if they had been in that condition at the time of report by the Sub-inspector the Defendant would not have been troubled. He found that all the notices were good in law, and that the plans passed in 1873 met the circumstances of that day, but might not suffice for all time. He found that at the time of the notices and proceedings the privies and ashpits were out of repair, but now they were in good repair, and every complaint made about them in the Sanitary Inspector's report had been remedied. He thought the true construction of the Corporation's Act was that the work should be executed according to the specifications and detailed drawings of the Corporation, and

not that plans must first be furnished by the Defendant for Corporation approval. He also found that since 1892, in the case of all new houses, it had been obligatory to provide water-closets according to the specifications and detailed drawings, and that where persons had to submit plans they must show water-closets. He had dealt with all the questions and points arising in the case, and, although his personal view was that the powers of the Corporation were of a very arbitrary and stringent character, it was his duty not to criticise the law, but to administer it to the best of his ability and judgment; and he therefore inflicted upon the Defendant a penalty of 20s. and 8s. costs., with the alternative of seven days' imprisonment.

As application was made for a case to be stated for the High Court; we cannot comment on the case. We would, however, direct attention to the cases of "Wood *v.* Mayor, etc., of Widnes" (62 J.P., p. 117), and "Robinson *v.* Mayor, etc., of Sunderland" (62 J.P., p. 216), both of which were decided under the Public Health Act, 1875.

QUEEN'S BENCH DIVISION.

(*Wednesday, May 25th,* 1898.)

Before Mr. Justice Wills and Mr. Justice Channell.

LOGSDON *v.* HOLLAND.

This was a case stated by Mr. J. R. W. Bros, the Metropolitan Police Magistrate, before whom the Appellant was charged, on the information of the Respondent, for that on October 16th, 1897, he, being the registered keeper of a common lodging-house in London, did neglect to give immediate notice to the London County Council, or some officer thereof, of a person having been ill of fever or infectious or contagious disease in such common lodging-house, contrary to section 11 of the Common Lodging-houses Act, 1851. The facts were shortly as follows:—The Respondent was the registered keeper of a common lodging-house, situate at Nos. 14 and 16, Middle Row, St. Luke's, and one Patrick Breen acted as his deputy at the common lodging-house, and had the care and management thereof. On October 14th a son of Patrick Breen was taken ill at the common lodging-house and the same day was removed to St. Bartholomew's Hospital, and on October 16th was brought back to the common lodging-house suffering from scarlet fever, and was afterwards removed to a fever hospital. Patrick Breen knew on October 16th that his son was ill of scarlet fever, but no notice was given to the London County Council as required by section 11 of the Common Lodging-houses Act, 1851, until October 22nd, when notice was given by the deputy. There was no evidence that the fact of a person being ill of fever in the common lodging-house came to the personal knowledge of the Respondent before October 23rd, 1897, and the learned Magistrate found as a fact that he did not previously know of it before that date. The learned Magistrate refused to convict upon the ground that the Respondent could not give notice

of what he did not know, and that there was no neglect of duty by him.

Mr. AVORY appeared for the Appellant, and contended that the section imposed a duty on the keeper of a common lodging-house from which he would not escape by leaving the management of the house to a deputy.

The Respondent did not appear.

The Court allowed the appeal, and remitted the case to the learned Magistrate with directions to convict.

Mr. JUSTICE WILLS said the case was very clear. The section in express terms cast upon the keeper of a common lodging-house the duty of seeing that its provisions were complied with, and, comparing the section with the succeeding sections, it was abundantly clear that the Respondent was liable to a penalty under the circumstances.

THE BRIGHOUSE MEAT CASE.

On the 19th October last the Medical Officer and Inspector of Nuisances went to the Public Abattoir at Brighouse, and there seized a carcase of beef which in their opinion was affected with tuberculosis. On their evidence it was condemned by a local Magistrate and destroyed, and subsequently the butcher was prosecuted before the local Bench, but the case was dismissed upon a technical objection, the nature of which is not clearly set out in the report before us.

The Butcher then availed himself of Section 308, which provides for arbitration, and the case was heard by a Barrister as Arbitrator, the damages claimed being £1000.

The case for the Claimant was that the tuberculosis was confined to the lungs and pleura, but that the rest of the carcase was fit for the food of man, and not liable to seizure. In support of this contention evidence was given by several butchers, and also by Mr. Walker, M.R.C.V.S., of Halifax, and by Dr. Hime, of Bradford.

For the defence it was argued that it was not a question for arbitration under the Section, but for a civil action; that the seizure was good in law; that the proceedings before the Magistrates in Court did not materially affect the case, and that the Claimant was in default.

Evidence as to the unfitness of the carcase for food was given by the Medical Officer of Health, the Inspector, and the condemning Magistrate, also by Messrs. Findlay and McKinna, Veterinary Surgeons, who had seen the carcase and the offal, and by Dr. Kaye, of the West Riding, upon the general question of tuberculosis.

The result of the case was a decision of the Arbitrator of £101. 11s. and costs, against the Corporation, amounting to nearly £400.

We understand that it is the intention of the Corporation to resist the recovery of this sum to the last, and we shall be interested to see what attitude expert witnesses will take as to the danger of eating the flesh of an animal whose "lungs and pleura were thickly studded

with masses of tubercle" with "an increase of the tubercles towards the edges of the lungs and an adherent diaphragm," with also "specks in the kidneys which were probably tubercular." The facts are taken from the evidence of the Butcher's witness, and consequently are free from any *ex parte* statement.

It is well known that there is some difference of opinion as to the exact amount of tubercle which should render meat unfit for human food, and it has been claimed that we should await a Government pronouncement in the matter, but why it should be possible to question the *bona fide* action of a Medical Officer and the condemning Magistrate is not clear.

MANCHESTER ASSIZES, FEBRUARY, 1898.

Before Mr. Justice Bruce.

THOMAS ORMEROD *v.* THE MAYOR, ALDERMEN, AND BURGESSES OF ROCHDALE.

This case, which was tried early in February before Mr. Justice Bruce and a special jury, raised some important points in connection with the Public Health Act, 1875. It was an action brought by the Plaintiff, a butcher at Buersil, within the Borough of Rochdale, to recover damages from the defendant Corporation for having by their servants, the Medical Officer of Health and Inspector of Nuisances, entered his premises and wrongfully seized and destroyed part of the carcase of a cow, whereby his business had been ruined.

Mr. Shee, Q.C., and Mr. Butterworth, were for the Plaintiff.

It appeared that the Plaintiff on June 14th, 1897, purchased a cow and slaughtered it. One side of it was sold to a man named Collins. On June 17th one of the Defendants' Inspectors called at the Plaintiff's shop, and, after examining the remains of the side, went for the Medical Officer of Health. The latter, Dr. Henry, called shortly afterwards, and condemned the meat as being unfit for food. The meat was then taken to the town's yard, where, after being examined by veterinary surgeons on behalf of both parties, it was ultimately destroyed. The Plaintiff's contention was that the meat was sound, and that *the Defendants were liable for not having first taken the meat before a magistrate and obtained an order for its destruction, as required by sections* 116 *and* 117 *of the Public Health Act*, 1875. The defence was that the meat was unfit for food, and that the Plaintiff assented to its being destroyed. The Defendants further raised a somewhat novel point—that, although the meat was good, they were not liable for acts of the Medical Officer of Health, as his appointment was compulsory under section 189 of the Public Health Act, 1875, and although paid by the Defendants, he was not their servant, and they were not responsible for what he did, as they had no authority over him. In the result the jury found a verdict for the Plaintiff with £50 damages. The legal points raised by the

defence subsequently came on for argument, and his Lordship, in giving judgment on Friday, February 11th, for the Plaintiff, said that neither under the local Acts in force at Rochdale nor under the Public Health Act, 1875, had either of the officers in question any authority to destroy meat without an order of the justices. The destruction of the meat could not, therefore, be justified, and the question arose as to whether the Corporation were liable for the acts of the officers. In the resolution of the Corporation appointing the Medical Officer of Health it was stated that in any case which he might think desirable he should himself inspect any animal or meat exposed for sale which was deemed to be diseased or unsound. If he found such was the case, he could give instructions for the animal or the meat to be destroyed. The power to appoint the Medical Officer was vested in the Corporation, who were authorised to pay and fix his salary, and who had conferred upon them power of removal. So far as he had ascertained there was no reservation of those powers, and the appointment was in that respect unlike the power conferred by the Public Health Act in cases where the salary of the Medical Officer was paid partly out of money voted by Parliament, and where the power to appoint and remove was subject to the control of the Local Government Board. The Officer of Health in this case, he thought, must be regarded as the servant of the Corporation. They appointed him, they paid him his salary, and he was appointed to carry out the regulations made by the Corporation. He was bound under those regulations to seize meat in cases in which he might be so directed by the Health Committee, or the Corporation might give him three months' notice of dismissal It was equally clear that the Inspector of Nuisances was also a servant of the Corporation, though he did not think it necessary to go at length into that question, because he acted, as he was bound to do, under the directions of the Medical Officer. The only question which remained to be considered was whether the Medical Officer acted within the scope of his duties or whether they were both so acting. He answered both those questions in the affirmative. The Officer of Health and the inferior Officer were authorised to seize meat if it appeared to them to be unfit for food. *They neglected to take the proper steps*, but the irregularity was in the course and manner of doing something they were authorised to do.

Upon the application of Mr. Sutton a stay of execution was granted on £20 being paid into Court, and notice of appeal to be given within twenty-eight days.

GENERAL NOTES.

NINTH INTERNATIONAL CONGRESS OF HYGIENE AND DEMOGRAPHY, MADRID.

The International Congress was held at Madrid from April 10th to the 17th, under the Presidency of His Excellency The Minister of the Interior. The Congress was divided into ten sections of Hygiene and three for Demography. Some 2,000 persons attended the Congress, but the English were comparatively few in number, probably not more than fifty being present. The London School Board was represented by the Hon. E. Lyulph Stanley and Mr. Bridgeman; the University of Cambridge by Dr. Donald MacAlister; the Home Office by Dr. Thomas Oliver, of Newcastle-upon-Tyne; the Army Medical Department by Surgeon-Major-General Macpherson; The Sanitary Institute by Mr. T. W. Cutler, F.R.I.B.A.

Inaugural Address.—The inaugural address was delivered by Dr. Calleja, the Dean of the Faculty of Medicine, Madrid, who in a few well-chosen words extended a warm welcome to the members of the Congress. The meeting of the Congress in Madrid, he said, had given cause for great satisfaction and pleasure throughout Spain, but he wisely reminded the large audience that the science of public health was confined to no nation in particular and to no one science specially. In front of him he saw distinguished ladies, prelates, soldiers, engineers, architects, statisticians, and medical men all working with one aim and paying homage to sanitary science. Hygiene could no longer be regarded as simply one of the studies of medicine and the least important of it. It had no individuality and an independence now all its own, although originally a branch of the science of medicine. Its object was the prevention of disease not its cure, the investigation of the causes of disease, in order, if possible, to destroy them or minimise their effects. Hygiene was a science whose character was foresight and prudence. Just as moral science secured purity of the soul so did hygiene seek to secure the conservation of the health of the body. It was morality of the body. The precepts of hygiene were daily becoming more and more recognised, but it was still necessary to labour with patience, constancy, and self-denial, for nothing like perfection had yet been arrived at. After paying a tribute of respect to the immortal Pasteur, the President alluded gracefully to the meritorious work now being carried on by medical men on the banks of the Ganges and the Nile in order to discover and subsequently destroy, if possible, the harmful germs of pestilential diseases. Statistics and demographic science were powerful aids to hygiene. Sanitary science was hampered by all sorts of obstacles. Municipal bodies objected to it on the ground of expense; individuals in the belief that their liberty was being interfered with; but it was clear, he said, that while a citizen had rights, he also had duties imposed upon him by society, and which he must respect. The individual was less than society, of which he was simply a part, and should not be at liberty to infect his neighbour. This fact, while a moral, ought to be a legal, truth. England, so liberal in most matters, had broken her traditional respect for the sacredness of the home when during epidemics she brought her preventive measures into action. Dr. Calleja showed how necessary it was for all to co-operate, and with energy, in order to advance hygiene, and the need there was for procuring Government help in the matter of research. Spain, he said, would lend all the influence of her authority to help forward the cause of sanitary science. The address was listened to with great attention, and was extremely well received.

Among the subjects discussed in the various sections of the Congress were:—

The Sanitary History of Houses.—An interesting question was discussed in one of the Sections relating to the health of towns and the registration of the houses. There is no reason why the sanitary history of each house in a town should not be made a matter of registration. It is known that certain parts of a city are more the dens of fever than others; that consumption and cancer, for example, are more frequently met with in some places than in others. There was an almost unanimous feeling in the Congress in favour of the sanitary records of town houses being kept by the proper municipal authority, so that at any time comparisons could be instituted as regards the frequency of fevers, tuberculous disease, etc. Apart from the statistical interest attaching to a pigeon-holing of such facts, the value of the knowledge gained would be great.

Hygiene of Schools.—Senor AUGUSTIN SARDA, Councillor to the Public Instruction Board of Spain, caused a tremendous ferment because he pleaded that children should not have any books given them till they were eleven or twelve years old. This, he said, was necessary for sanitary reasons, as a child under that age should not work more than six hours, therefore should have no home-work. On the other hand, while the child was at school the time should be employed listening to his instructor rather than reading books. From the pædagogic point of view he urged that if young children were made to learn lessons from books they got into the habit of referring to books instead of seeking to develop their own ideas. On this comparatively inoffensive beginning the whole system of education came under criticism, till at last one speaker went so far as to say that the present methods of teaching bred criminals. Of course, this was violently denied, and the excitement went on increasing till, from the sanitary point of view, the more appropriate subject of school colonies was introduced. On this latter subject the section voted in favour of the following resolution or "conclusions," as the declaration is called:—

"Considering that holiday colonies have been established in many countries for more than twenty years, by which children from the elementary schools are taken from large towns into country districts during the holidays and thus removed from the contaminating influence of the streets; that among pupils of from ten to twelve years the benefits resulting are recognised by the most eminent authorities; that these benefits comprise a greater increase in size, chest measurement, and weight gained during three weeks of country life than during six months of town life; that such a marked improvement constitutes a very valuable means of conferring vigorous health to the children; that the advantage gained from the physical and intellectual point of view continues to subsist for many months after the child has returned to town; that the habits of discipline, cleanliness, and self-control acquired in these colonies by the example given, or the desire of the pupils to prove their gratitude towards those who have procured for them so agreeable a holiday are brought home by the pupils and do not fail to influence their parents and families for good, and that altogether a better tone and sentiments of fraternity are engendered; that the simple character of the life in these school colonies dispels all ideas of luxury which might corrupt the pupils; that the cost of such colonies has never exceeded 2s. 6d. per day per pupil, and that for a little over £3 a pupil may be sent to a school colony for three weeks (disposable school funds could scarcely be employed more advantageously and economically);—for these and many other reasons the Sixth Section of the Congress of Hygiene expresses its desire that municipalities' school funds, cantonal delegations, &c., should take in hand the

establishment of school colonies. The Sixth Section recommends this sort of institution as one of the means that is best calculated to ameliorate both the moral and physical condition of the pupils and, in some instances, of their parents."

The same section passed a resolution to the effect that children suffering from ophthalmia should not be absolutely excluded from school, but should be grouped together in a separate class-room. In hospitals, however, such cases should be relegated to a separate special wing or pavilion.

The Tuberculosis Antitoxin.—A communication of particular importance was that of Dr. Behring on the toxin of tuberculosis. He began by saying that the vaccine of tuberculosis had not yet been found. The discovery of the tubercle bacillus was indeed epoch making, but it was still uncertain what would come of it. For his part he had hoped to find an active antitoxin with a corresponding toxin; but so far he had been unsuccessful. He would even be sceptical as regards such a result had he not found that birds were much more suitable for this kind of research than mammals. With sodium and other reagents mucin as well as other chemical substances could be extracted from tubercle bacilli. These bodies had nothing to do with the toxin of tuberculosis. If the bacilli were subjected to a temperature of 150° C., freed from fat, and treated with glycerinated water, insoluble albuminous bodies were obtained which had a virulence twenty times greater. The toxin of tuberculosis was therefore not identical with the primitive substance. The chemical constitution of the toxin was not modified by the operations to which it was subjected. Behring stated that the substance which he had isolated was eighty or even a hundred times more virulent than Koch's tuberculin. He had also obtained an antitoxin by passing the virus through the horse, in the same way as was done in the case of diphtheria and tetanus. There was however, this difference, that in a phthisical patient more than 0·5 c.cm. to 1 c.cm. could be injected without producing injurious effects, general as well as local. Behring lays it down as a principle that the harmlessness of an antitoxin is an indispensable condition of its practical application; but there are many other difficulties which must be overcome before an antitoxin of tuberculosis can come into use in the treatment of human beings. In bovine animals it is already possible by its means to cure a declared tuberculosis; but even in them one gathers that the remedy at present is somewhat dangerous to life. This, however, it is pointed out by Behring, is important only from the economic point of view. If of 100 animals treated with the serum 90 are cured and 10 are killed, the treatment should still be adopted. Experiments on an extensive scale are to be made in the Berlin Veterinary School in order to determine the value of the treatment.

Behring took occasion to insist once more on the necessity of the degree of virulence of the toxin being accurately known. For this purpose the manufacture of serums must be under the control of a competent person. He suggested that an international system of control should be organised. The accurate regulation of the potency of antidiphtheria serum formed the subject of a communication by Dr. Janowsky, of Warsaw, who urged that a uniform standard should be adopted by all countries. He proposed that the Congress should pass a resolution to the effect that a normal type of serum should be fixed in order that the therapeutic effects reported by observers in different countries might be fairly comparable. The proposal was warmly endorsed by Loeffler, who suggested that it would be well to enlarge the scope of the resolution so as to include all therapeutic serums. Chantemesse said he did not see the necessity of fixing an international

standard of serum. Spronck, of Utrecht, proposed that a serum of minimum intensity—for example, 10,000 units—should be established for universal use. Calmette, Nocard, and Chantemesse expressed the opinion that a competent committee should be appointed to prepare proposals to be submitted at the next Congress. It was decided that a committee of experts should be appointed to consider whether there would be any advantage in having a uniform international standard of strength in the case of antitoxic serums.

The following series of Resolutions, prepared by Prof. Corfield, were adopted as Resolutions of the Congress.

They may be taken to represent the maximum amount of agreement possible at the present moment among sanitarians of different European countries.

1. That the general health of the population is improved and the spread of diseases prevented in towns and dwellings by the immediate removal of all foul matters and by a copious supply of pure water.

2. That the paving of streets should be smooth and as far as practicable impervious, to facilitate cleansing and also to prevent contamination of the subsoil.

3. Special measures should be taken in the construction of houses to prevent the access of ground-air and moisture to the floors and walls.

4. House drains should be arranged so as to avoid stagnation of their contents and to secure a rapid flow to the street sewer. Their walls should be impervious to liquids and gases, they should be freely and continuously ventilated and provided with siphon-traps to prevent the access of foul air to the houses.

5. The public sewers should be so constructed as to ensure the rapid and uninterrupted flow of the sewage to their outlets. They should always be freely ventilated.

6. The streets should be as wide as possible in proportion to the height of the houses; this proportion should be fixed in each locality, regard being had to local circumstances and to climate. Every inhabited building should be well lighted throughout its whole depth, and arranged so as to have an access of air from at least two sides.

7. Special regulations should be made in each locality by the public authorities with the view of enforcing the practical application of the principles herein laid down. Governments and municipalities should resolutely and energetically carry out the preceding recommendations, especially those concerning the healthiness of dwellings.

The next meeting of the Congress has been arranged to be held in Paris in 1900. T. W. C.

TUBERCULOSIS AND THE MILK SUPPLY.—A conference on this subject was recently held in the Station Hotel, Keswick. It was attended by a large number of medical officers of health, veterinary surgeons, and public men in Cumberland and Westmoreland.

Canon Rawnsley, who presided, in introducing the lecturer, said Professor Delepine, of Owen's College, Manchester, who would address them, had spent the last ten years of his life in patient original research in connection with tubercle bacillus and their milk supply, and he stood to-day among the first of the land as an authority upon this gravely-important matter.

Professor Delepine said there was in this country not a herd of cattle, nor a cow-shed of any size, which was free from tuberculosis. Their milk was mixed with other milk, and all this, or most of it, was done in perfect ignorance and without any intention to defraud. Once tuberculous cattle

were got rid of, and infected places cleared in any district, it would be possible to make any person introducing tuberculous cattle responsible for such an action. It was a fact that one-tenth of all deaths were due to pulmonary phthisis alone. There was absolute proof that the disease was produced by nothing else than the tubercle bacillus, which might penetrate the body in various ways, but the two most important channels of entrance were the air and the food passages. Statistics showed that tuberculosis of abdominal organs was far from infrequent in children. In one quarter of the children dying from any cause during the second year of their life, tuberculosis lesions could be found. In a large proportion of these cases there was good evidence to show that the bacilli had entered through the alimentary canal, and must have been introduced with cow's milk. By putting together figures collected in England, France, Germany, Denmark, Holland, and based on the examination of some 600,000 head of cattle, he had found that on an average more than 16 per cent. of all cattle might be tuberculous. It was, however, fortunate that the milk of tuberculous cows did not usually become infectious unless the udder be diseased, and it was still more fortunate that the udder became affected only in a small proportion of tuberculous cows. In Manchester he had examined specially the milk of 24 tuberculous cows in which the disease was advanced, and found that in six of the cases the milk was capable of producing tuberculosis. He might say further, that in five out of six cases the udder was certainly diseased, and in the sixth disease was probably present. Six or seven per cent. of the samples of milk examined on arrival at railway stations were capable of producing tuberculosis, and he had no doubt a very large number of children were killed by it every year. As to the remedies, the speaker suggested the boiling of the milk by consumers; the systematic inspection of their cow-sheds and milch cows by competent men, before it produced symptoms obvious to all; that the milk from diseased cows should be excluded from the milk of the herd, although after boiling it would still have a commercial value; the fattening of tuberculous cows for slaughter whenever the disease had not reached serious proportions; the thorough cleaning, lighting, and ventilating of cowsheds; the cattle entering a county from other counties, or from abroad, should be examined; that the cattle kept in a county should be registered, inspected, and tested; that the breeding of healthy cattle should be encouraged, and calves could be easily protected against the chance of infection if preventive measures were taken; and that tuberculous servants should not be tolerated either in cowsheds or dairies; and that all pails and cans should be kept scrupulously clean. Two measures he regarded as essential—(1) the systematic and periodical inspection of cowsheds and cows for the purpose of weeding out tuberculous animals; and (2) the testing of all cattle brought into a given county, so that fresh sources of tuberculosis should not be introduced. If such measures were taken it would only be right to see that foreign dairy products were not allowed to flood their markets unless a good guarantee were obtained that proper measures had been taken to safeguard the consumer, who, the speaker urged, should, as a matter of justice, share the cost of a crusade against tuberculosis in cows.

A discussion followed.

The Cleansing of Persons Act passed in the last session of Parliament was a distinctly sanitary measure, as it gave local authorities the power of providing free of charge means of cleansing for persons and their clothing, without such persons passing through the workhouse or the casual ward.

When the Act was passed some doubt was expressed as to whether any

considerable use would be made of any such voluntary facilities for personal cleanliness.

The plan has been tried by the Marylebone Vestry, and a bath erected in Grove Road, and has been found eminently successful.

Mr. Wynter Blyth, the Medical Officer of Health to whom the successful administration is due, states in his report that "on the very first day, however, 2nd March, when the bath was ready for use, there were four applicants. From 2nd March to 31st March, a period exclusive of Sundays of twenty-five days, 148 persons, or on the average about six per day have attended at the premises, bathed, and simultaneously have had their clothes disinfected by super-heated steam.

With the exception of one woman all the applicants have been males, 134 have given as an address the Salvation Army Shelter; eight the Shaftesbury Institute, and six various common lodging houses in the Parish. By far the majority have evidently for some time suffered great discomfort, the skin being in a state of eruption from parasites, the hair matted from filth, and the clothes indescribably foul. A few of the applicants were so offensive as to constitute a nuisance. What chance such men would have of getting even casual employment may be gathered from the fact that a brief interview in the open air would excite a feeling of nausea and repulsion. The operation of the act thus affords an opportunity for a certain class of the extremely poor to obtain decent regular employment. Besides such personal advantages the diminution of the possibility of cleanly people becoming accidentally infected with loathesome skin diseases from mixing in crowds or making use of the public seats in the Parks and open spaces, is a distinct public gain."

It is to be hoped that many Sanitary authorities in London and other large towns will adopt the powers conferred by this act and obtain equally good results in improving the cleanliness of this country.

Examination for Sanitary Officers in the United States.

The Members of The Sanitary Institute will be glad to see from the following letter that the important pioneer work accomplished by The Sanitary Institute in the founding and organising of Examinations for Sanitary Inspectors is forming the basis for similar Examinations in other parts of the world. It has for many years been the practice of the agents of some of the Colonies to refer to The Sanitary Institute for assistance when making Sanitary appointments, and the New Jersey State Board of Health have gone a step further by establishing Examinations of their own.

Dear Sir,

I am now able to inform you that this Board has succeeded in establishing a system for testing the fitness of applicants for appointment to the office of Sanitary Inspector by the Local Health Authorities of this State, and I desire to express thanks for your kindness in forwarding for our use particulars relating to the lectures and demonstrations employed by The Sanitary Institute. I also wish to inform you that the material referred to has proved to be exceedingly useful, influencing the favourable action which was finally taken by the Rutgers College Authorities.

Enclosed please find announcement relating to the Examinations.

Very sincerely,

To the Secretary of the Sanitary Institute. Henry Mitchell, *Secretary.*

The Examinations are divided into four classes :—(1) Executive Health Officers; (2) Sanitary Inspectors; (3) Factory Inspectors; (4) Plumbing Inspectors. In the list of books recommended for the use of candidates, Parkes' Practical Hygiene is the first mentioned.

Kenny & Co., Printers, 25 Camden Road, London, N.W.

Volume XIX.—Part III.] [October, 1898.

JOURNAL

OF

THE SANITARY INSTITUTE.

CONGRESS AT BIRMINGHAM.

INAUGURAL ADDRESS,

By Sir JOSEPH FAYRER, Bart., K.C.S.I., LL.D.Edin. & St.And., M.D.Edin., F.R.C.P.Eng., Q.H.P., F.R.S.

(Fellow.)

Delivered September 27th, 1898.

My first duty on taking the chair is to acknowledge the honour conferred on me in selecting me as President of this Congress; and my next to offer a cordial welcome to all who propose to take part in its proceedings, and to express a hope that they may not only derive pleasure and profit from them, but at the same time confer benefit upon the cause they advocate.

It is also my duty to convey the thanks of the Congress to the Right Honble. the Lord Mayor and Corporation for the hospitality and courtesy which has been extended to it in the important city of Birmingham, a great and populous centre of activity, to which the problems to be considered in the forthcoming conferences must be of deep and abiding interest.

It is not without misgiving that I have assumed the office entrusted to me, for when I think of those who have been my predecessors, I feel painfully conscious of my inaptitude for the post that they have filled so well. I must confess, moreover, that I found some difficulty in selecting a topic suitable for an inaugural address, but can only hope that my shortcomings may be redeemed by the proceedings of the various sections into which the Congress is divided.

I shall not attempt to deal with any special branch of

preventive medicine or hygiene, but shall endeavour to take a brief general survey of progress during recent times. It should be a retrospect full of interest, offering scope for many addresses on special branches of sanitary science—such, indeed, as I hope will characterise the coming Conference.

We live in an age of progress and discovery. Intellectual activity has never been greater, scientific research never more profound or far-reaching, whilst the practical applications of the discoveries of science are not less remarkable. Among many subjects of interest which were laid before our gracious Queen on the completion of the sixtieth year of her glorious reign, few perhaps if any afford better ground for congratulation than the improvement in the vital statistics of her people, as shewn by reduced death-rate, enhanced expectation of life, decline in some of the most potential death-causes, and the almost total disappearance of others.

In effecting this improvement, the Institute which I have the honour to represent and which holds its 17th Annual Congress this year has taken an important part. It was the outcome of the impulse given to sanitary science by the Public Health Act of 1875, which itself was a result of the growing conviction that public health was a subject which demanded more consideration than it had hitherto received.

At a public meeting held in London in July, 1876, presided over by His Grace the Duke of Northumberland, it was resolved that the sanitary condition of the country is still very unsatisfactory, that further legislation is necessary with a view to its improvement, and that for the purpose of collecting and imparting information upon all matters connected with the subject of "Public Health," a society be formed to be styled "The Sanitary Institute of Great Britain," and a committee was appointed to give effect to the terms of the resolution. Since then the progress of the Institute thus founded has been uninterrupted, and its influence for good has steadily increased. In the same year, 1876, the Parkes Museum was founded at University College as a memorial to Dr. E. A. Parkes, first Professor of Hygiene at Netley, and in its galleries were exhibited various hygienic appliances for the purpose of affording information by the objective method of teaching. Its Council originated and managed the International and Sanitary Exhibition at South Kensington in 1881, which was presided over by the Duke of Edinburgh. It was in 1882 incorporated as a society, its treasures were transferred to the present premises in Margaret Street, where it was joined by the Sanitary Institute, and the two institutions having a common object worked harmoniously together and practically became one. In August,

1888, they were formally amalgamated and re-incorporated under the title of The Sanitary Institute. In 1887, just before the amalgamation took place, the Institute, in conjunction with the Society of Medical Officers of Health, invited the International Congress of Hygiene and Demography to meet in London, which it did in 1891 with great success.

The object which the Institute has kept steadily before it from the outset has been the advancement of sanitary science by the promulgation of sound scientific and practical teaching of those principles on which health depends, by which life is prolonged, and the physical and thereby the moral welfare of the people promoted.

One of its earliest steps, taken in 1877, was to establish examinations for Local Surveyors and Inspectors of Nuisances, in order that the officers who had to carry out the provisions of the Public Health Act should be competent for their duties. The Council also arranged to hold an Annual Congress in some provincial town, in order that papers should be read and discussions take place, whilst, at the same time exhibitions of sanitary appliances were arranged as object lessons, and judges appointed to examine the exhibits and award prizes. Since the amalgamation with the Parkes Museum the same work has been continued, with the addition of periodical meetings, at which papers are read and discussed, the publication of transactions, and advanced examinations; while to aid the important teaching work it was carrying on, it collected and published the works of Farr and of Simon, which deal exclusively with the problems of sanitary science. It has gradually accumulated an excellent library, and instituted lectures and practical sanitary demonstrations for the benefit of medical men and of sanitary inspectors, which subsequently were considerably extended and more elaborately organized. Under the patronage of the Duchess of Albany and the Presidency of the Dukes of Northumberland and Westminster, and latterly of the Duke of Cambridge—who had already been connected with the Institute for fourteen years, and had not only displayed great interest in its work, but had rendered it valuable assistance, and under the guidance of such men as Sir Douglas Galton, Earl Fortescue, Sir Francis Powell, Mr. Rogers Field, Prof. Corfield, and others who had been its early supporters and founders, it steadily developed its purpose of diffusing practical sanitary knowledge throughout the country and attained its present influential position.

An idea may be gained of the scope of the operations of the Institute by reference to the epitome of the work done in 1897, which was as follows:—

London Lectures and Examinations.	Total Attendance.
4 Sessional Meetings for discussion of Sanitary Subjects	285
36 Lectures to Sanitary Officers	2,251
2 Special Demonstrations, Inspection of Meat ...	140
34 Practical Demonstrations for Sanitary Officers ...	925
2 Examinations in Practical Sanitary Science ...	34
2 Examinations Sanitary Inspectors	213
138 Classes brought to the Museum	1,674
Other persons visiting the Museum (estimated) ...	17,500
Provincial Examinations.	
8 Examinations Sanitary Inspectors and Practical Sanitary Science	316
Congress and Exhibition at Leeds.	
6 Sectional Meetings	706
8 Conferences	850
3 Addresses and Lectures	956
Exhibition open for 23 days, at which a number of Lectures and Demonstrations were given ...	75,790

All this is effected entirely by private enterprise, unaided by any subsidy either from Government or other public authority, by which it is from time to time consulted, and to which its services are most willingly rendered. As an illustration of the progress made it may be stated that when the first Congress took place in 1877, there were 150 members and the income was £240. In 1897 the members were 2,100 and the income £6,000. In 1877 five candidates were examined for certificates, in 1897 521 were examined, of whom 300 obtained certificates.

Such is a brief outline of the history of The Sanitary Institute. But it is by no means the only source of instruction in matters relating to Hygiene and Preventive or State Medicine, for all our Medical Schools and Universities, the Army and Navy Medical Schools at Netley and Haslar, and many technical schools now give instruction in those subjects, and the Universities and Colleges of Physicians and Surgeons attest the fitness of candidates for the Diploma of Public Health. One great national reproach, moreover, has lately been removed by the foundation, by private enterprise of the Institute of Preventive Medicine, under the presidency of Lord Lister, with which is amalgamated the College of State Medicine. The object of this Institution is to search out the causes of disease, a knowledge without which we cannot hope to deal effectively with modes of prevention. The Medical

Departments of the Navy, the Army, and the Local Government Board, the Army Sanitary Committee, the Royal Institute of Public Health, many municipal and rural Health Societies, and Societies of Medical Officers of Health, are actively employed in extending the practical application of the knowledge imparted by the various educational institutions as well as by individual research.

The time at my disposal does not permit of tracing in detail the history of the growth of Sanitary Science from times of ignorance and superstition to its present well-established foundation on a scientific basis, but I may at once say that it is indeed only comparatively recently that preventive as distinguished from curative medicine has assumed the position of a science at all; it is now from a hygienic point of view, the more important of the two, though the difficulties attending its application are still considerable and largely such as arise from ignorance and incredulity.

Half a century ago the great mass of the population lived and died under conditions which violated all the now well known principles on which health depends; prejudice, ignorance, and vested interests stood in the way of progress, and but little effort was made to correct the one or remove the others; government looked on with indifference; the people knew little and thought less of the efficacy of pure air, pure water, cleanly and uncrowded dwellings, temperance, and other conditions which are now well known to be essential to health. They had no idea that infective disease is but too frequently the scourge of uncleanliness, overcrowding, and disregard of simple laws of health.

Under the influence of such reformers as Chadwick, Parkes, Richardson, Simon, Southwood Smith, Sutherland, Bristow, Buchanan, Netten Radcliff, De Chaumont, Corfield, Thorne, Notter, Seaton, L. Parkes, Ballard, Power, A. Hill, Armstrong, Russell, Littlejohn, Cameron, Smith, Ransom, and others, to say nothing of Sanitary Engineers such as Rawlinson, Galton, Rogers Field, Hawkesley, Mansergh, etc., measures which were regarded as mere theories or fads of no practical value, are now accepted as of cardinal importance. Statesmen have learnt to realise that Sanitary Science comes well within the sphere of practical politics, and that it is an important part of the duty of executive governments, whether general or local, to protect the people from disease which may be prevented or controlled.

Numerous Acts of Parliament have been passed, such as the Public Health Act of 1875, Rivers Pollution Prevention Act 1876, Public Health (Water) Act 1878, Acts for Housing

the Working Classes 1885 and 1890, Infectious Diseases Notification Act 1889, Infectious Diseases Prevention Act 1890, Isolation Hospitals Act 1893, Public Health Act for London 1891, and many others. Officers of Health, Sanitary Engineers and Sanitary Inspectors have produced a better state of things; the poor are no longer left to be a law unto themselves on such matters. Public health is cared for in a sense which was utterly unknown in the past; houses are better built, sewerage, drainage and ventilation are provided for, the land is better cultivated, the subsoil better drained; the absolute importance of pure drinking-water is recognised, food is more varied and more nutritious in its character, clothing is better adapted to climate: and were all the existing official provisions enforced, little would remain to be desired on the part of the Executive government; but as some of these Acts are permissive, not compulsory, and as others are utterly neglected, much of the benefit they might confer is lost.

Though education has done much as far as the better classes are concerned, and upwards of 200 millions have been spent on sanitary work, with great benefit to the public health, popular teaching and example, and the general diffusion of education, are still necessary in order to convince the proletariat of what so intimately concerns their vital interests. The death-rate is susceptible of further diminution, expectancy of life may be enhanced, and the general conditions of living and exemption from certain forms of disease are by no means as perfect as they might be; tainted water is still drunk, as was illustrated by the condition of Maidstone and King's Lynn last year, where an extraordinary visitation of typhoid fever was traced to impure water, shewing either that legislation was imperfect or that its provisions had not been duly observed. Chimneys still vomit forth their smoke and chemical fumes, rivers are still polluted, cesspools and imperfect drains, badly constructed, ill-ventilated houses, and so on, still defy alike sanitary law and common sense; and it will perhaps not be until the more complete organisation of the public health administration under a Minister of Public Health be effected, that the full benefits of sanitary legislation will be realised and the people attain to that standard of health and duration of life for which they have a right to hope.

Even our great cities with all their improvements leave much to be desired. Notwithstanding Acts of Parliament, all the efforts of sanitary authorities, all the advice that may have issued from this and other similar sources, serious defects remain. Even your own great city, according to the journals, notwithstanding the splendid municipal arrangements for which

it is remarkable, has still a higher death-rate than some other great cities. Since 1882 up to 1897 it has stood at from 21·6 to 20·2, and the same authority points out sanitary defects which one may venture to think might be ameliorated.

In the first week of July in thirty-three of the largest English towns the rate of mortality, which had been 15·1 and 14·9 per thousand in the two preceding weeks, declined to 14·7. It was 14·3 in London, whilst it averaged 14·9 in the thirty-two provincial towns. The lowest death-rates were 9·4 in Cardiff, 9·7 in Huddersfield, 10·3 in Brighton. The highest rates were 17·9 in Plymouth, 20·3 in Newcastle, 21·4 in Sunderland. When the last quinquennium is compared with the preceding decennium it is found that Blackburn and Huddersfield have reduced their death-rate 4, Halifax and Cardiff 3·8, Oldham 3·7, Preston 3·4, Manchester 3·3 per thousand, while Birmingham has been practically at a stand-still.* If I am not mistaken, your own eminent health officer thinks that if the death-rate is to be reduced, it is essential that the improvements should be continued which had such a good effect some years ago. I merely venture to suggest it as a hint that may be worthy of the consideration of the municipal authorities.

Apropos of London, Sir Henry Burdett said in a speech made last year: "London, unfortunately, in regard to certain health matters is still under the control of the Vestries. * * * In the district of ——— for example, in this year of the Diamond Jubilee (wherein the greatness and majesty of the British Empire has been so convincingly exhibited,) the streets of one of the wealthiest portions of London are left unswept and uncared for from Saturday to Monday in each week. No matter how high the temperature, or how filthy the streets may be, the streets of probably the wealthiest district in the Metropolis of the Empire are made dangerous to health. * * * * Some of the most influential of the residents have entreated and protested in vain. The intelligent foreigner, to his surprise and disgust, may see in the streets of ——— on any Sunday when the principal residents are at home all day, fermenting filth and even dead cats, dirty papers and various kinds of offal, which offend the senses and infect the atmosphere to the danger of the inhabitants. Such a state of affairs is as shameful as it is unaccountable."

He might have added a paragraph upon the abominable and insanitary practice of sending out the vestry dust-carts to take away the house refuse at all times of the day. This

* "Lancet," July 16th, 1898.

proceeding is not only offensive to the eye and nose, but prejudicial to health. It ought to be promptly discontinued, and on no pretext ought dust-carts to be allowed in the streets after an early hour in the morning. Recent discussions in the House of Commons shew that the question of pure water supply also has not yet been satisfactorily settled or brought under the control of the sanitary authorities. It is to be hoped that disputes upon a question of such vital importance will not long remain unsettled.

Nevertheless, when we contrast the present state of our country with its 29 millions of inhabitants, with that of the Elizabethan era with its 4 millions, we have ample proof of the ignorance of science in those days and of the great improvements which have taken place in these. When we think of the ill-ventilated dwellings, the ill-built towns and villages, the narrow, unpaved, unlighted streets, uncultivated, marshy country, unreclaimed land, the wretched houses, often of wood or earth, without drainage or ventilation, with floors covered with straw or rushes saturated with filth and reeking with noxious miasmata, the stagnant gullies and open cesspools, to which must be added the wretched diet, often of salted meat, with little or no vegetable food, the intemperate habits, and frequently the most impure water, we can understand how under such conditions disease found a congenial nidus, and frequently assumed the epidemic proportions in which it proved so destructive to life, manifesting itself in the forms of the black death, sweating sickness, typhus, plague, eruptive fevers, small-pox, leprosy, scurvy, malarial fevers, and dysentery. Many of these have disappeared—never, we hope, to return—and others have been mitigated.

But can we feel confident that the immunity will continue? I am afraid not! Sudden invasions of cholera and other epidemics, and, as now, of plague in India, are warnings that our vigilance must never be relaxed. But the experience of our country under the greatly improved sanitary administration of the present time has shewn how much we may rely on preventive measures wisely enforced, especially when these are based on experience and enlightened observation, and not upon mere theories of causation.

A brief enquiry into the statistics of some well known diseases will show that they have become less severe in their incidence if not less frequent in their recurrence, and how far they are thus subject to the influence of hygienic measures.

In Small-pox, for example, there has been great reduction, more so than in any other disease. Since the passing of the first Vaccination Act in 1841, the death-rate has fallen from 576 per

million to 20 per million in 1891–95. Vaccination, isolation, attention to rational treatment, whether therapeutic or hygienic, have preceded or accompanied, and as most people believe, induced these results; and theories which ignore vaccination as a preventive must, it appears to me, necessarily be rejected until a better explanation of the cause of the diminished incidence and mortality from the disease can be offered.

As to the value of vaccination, all the evidence that is forthcoming seems to shew that there can be no doubt of it. As to the methods by which every individual is to be vaccinated or re-vaccinated, that is a subject for the State to determine. That the Acts in existence up to the present time are inadequate to this end is plainly shewn by the fact that large and increasing numbers of the population are known to be unvaccinated, despite their compulsory character. Lord Lister said in his speech in the House of Lords last August that one-third of the children born are unvaccinated, and that one-fourth of the Boards of Guardians do not put the law in force.

The most recent Vaccination Act, whatever may be its advantages, is certainly defective in this: that it makes no provision for re-vaccination, the necessity for which is universally admitted by the medical profession, whilst it is very doubtful whether the modification of the compulsory clauses will have the effect, as it is hoped, of extending vaccination. This remains to be seen during the five years for which the new Act is to be operative. Whatever the Government may have thought proper to enact, though there seems good reason to believe that as far as it is concerned faith in vaccination is unshaken, it must be borne in mind that the Royal College of Physicians have recently expressed their unaltered conviction, and it is endorsed by the whole profession, that vaccination "properly performed" and "duly repeated" is the only known preventive of small-pox, a view "which is confirmed by the experience of every epidemic, and is endorsed by those whose office it is to combat such outbreaks by all the resources of science. The characters of small-pox, its high degree of contagiousness, the rapidity of its spread on congenial soil, defy the efforts to suppress it by isolation alone or to arrest it in its earlier days of invasion, and if vaccination were not at hand to render its remarkable aid, the disease would become as common and as widespread in this country as it was in times when sanitary science was unknown." *

In 1838 the death-rate from fever at all ages was 1,053 per million; in 1891–95 it was 185 per million. It was not until

* "Lancet," August 6th, 1898.

1869 that enteric fever was separated from typhus, so that it is not possible to say how much of the reduction should be assigned to each, but the death-rate from enteric fever has been reduced by about 53 per cent. since the diseases have been differentiated, whilst typhus has almost ceased to exist. Now these fevers notably flourish where sanitation is defective, and as dirt, overcrowding and destitution have been diminished so has typhus disappeared, whilst with improved drainage, the removal of excretal filth, and the supply of pure water, enteric fever has become less.

There is reason to think that Cholera is similarly influenced, for though it has appeared in England several times since its first invasion in 1831, as in 1845–49, '53–54, '65–66, and even since as at Grimsby in 1893, yet its virulence and activity have been gradually diminishing. I believe we do not know all the conditions on which the origin and diffusion of cholera depend, but it has been shewn here, as in India, that whatever may be its ultimate cause it is amenable to sanitary laws; and that though we may not be able to prevent it altogether, we can so mitigate its incidence and severity as to deprive it of much of its terrors. Happily the antiquated system of prevention by coercion has in our country been replaced by that of sanitary measures and isolation, and it is to the wise and judicious exercise of these by the medical authorities of our Local Government Board and County Councils, and by Municipal authorities and Health Officers throughout the kingdom, that whilst neighbouring countries in the full practice of coercion and quarantine were decimated, England has lately remained almost exempt. It seems to me that few better examples of the benefit arising from vigorous action by Government, under the guidance of scientific authority, could be adduced.

Scarlet fever and diphtheria were formerly tabulated together; since 1859 they have been separately returned, and I learn from Dr. Louis Parkes (a most worthy successor of his distinguished relative and namesake) that "in 1838–42 the joint mortality was 797 per million living; in 1891–95 it was 435 per million, a reduction of 45 per cent. Since 1861–65 the scarlet fever death-rate has been reduced 81 per cent., but the diphtheria death-rate is now very much the same as it was over thirty years ago (1861–65), and about double the rate prevailing in the fifteen years 1866–80. Whilst there can be little doubt that improved sanitary and social conditions have played some part in the reduction of the scarlet fever death-rate, still the larger proportion of the diminished mortality is probably attributable to a change in the type of the disease."

With regard to diphtheria, it would seem "that sanitary

arrangements as such have had little or no effect upon the behaviour of the disease. The exciting cause is now known to be a bacillus, but we know little of the conditions—the predisposing causes—which favour the growth or virulence of this micro-organism, either inside or outside the human body, or which facilitate its transference from the sick to the healthy—conditions which must be studied if we are to ascertain why it is that diphtheria has made certain large centres of population its abiding place, and in its endemic homes assumes at times epidemic proportions. There is evidently some connection between elementary school attendance as now carried out and diphtheria prevalence, but the relation is not a very simple one, and is incapable of explaining all the facts of increased diphtheria incidence in rural populations."

Dr. Louis Parkes' remark suggests the necessity for studying all collateral conditions of other diseases as well as diphtheria, as being of equal importance with the microbe, which is believed to be the *causa causans*, and of more practical value as far as preventive measures are concerned.

In 1835–42 the death-rate from tuberculous disease was 3,959 per million, in 1891–95 it was 2,124, not so remarkable a diminution as in other diseases; but it serves to shew that sanitation has done good by helping to improve the ill-ventilated crowded dwellings, damp, waterlogged soil, impure water, and protection against noxious trades. Better drainage and drying of the subsoil have been shown by Sir G. Buchanan in this country, and Dr. Bowditch in America, to have been attended by diminution in the death-rate from this cause.

Dr. James Pollock, in a recent Report on the Hospital Treatment of Consumption, makes the following pertinent remarks: "In seeking for the cause of this vast improvement in the health of the country, we must attribute it mainly to improved drainage of the subsoil, more cleanly habits, removal of insanitary surroundings, better dwellings, and a higher standard of comfort in the lower classes. Bacteriology is the study of the hour, but it is plain that the presence of bacilli alone is not sufficient to account for all the phenomena of tubercular affections, and we are perhaps in danger of substituting the work of the laboratory and the microscope for clinical observation. However this may be, we have witnessed an enormous decrease of deaths from phthisis, and a decided lengthening of its duration. Fewer die of it, and are slower to die when affected. As yet we know of no agents which we can apply locally to the interior of the body for the destruction of bacilli or septic material. The energies of medical men are to-day devoted to preventive medicine, and in this consists our hope that the more

fatal diseases of our time may be extinguished." It is satisfactory to know that an Association has already been formed which has for its object the Prevention of Consumption and other forms of Tuberculosis, and as this is supported by the heads of the medical profession and other influential authorities, it is to be hoped that effective war will be waged against what is now considered to be a preventible disease.

As to malarial diseases, we may include them, in England at least, among those that have become all but extinct. The improved state of land drainage, the reclamation of marshy and swampy ground and more extensive cultivation have almost, though not altogether, eradicated a prolific source of disease and death which, though much diminished even in the early part of this century, had in past times caused the loss of many lives and great deterioration of health.

This disease is still the prominent cause of death in our Eastern Empire, as will be shown later; but the results of improved sanitation and the extension of cultivation and subsoil drainage, under the direction of the admirably conducted sanitary department of the Government of India, are there too producing good results.

It is not to be supposed that zymotic disease can be altogether exterminated, but we can modify and diminish its incidence, and as our knowledge of the real causes and the concomitant conditions which foster its evolution extend, we may hope, at least, if not to extinguish, so to attenuate as to render it comparatively harmless, as, indeed, has been the case with more than one scourge of our race.

The scope and aim of Sanitary Science in its preventive aspects should not be limited to the consideration of zymotic and other acute diseases, but should extend to the results of abnormal social conditions arising out of the strain and struggle for existence, involving over-competition in various occupations by which life is supported, or wealth and distinction acquired, and under the pressure of which so many lose their health or even succumb. For example, it frequently suggests itself that the over-pressure now exerted on the younger of the rising generation may not only involve the risk of miscarriage of true education, but dangers against which it is as much the duty of preventive medicine to guard young people as it is to protect them from scarlatina, small-pox, measles, cholera, or any other disease.

Again, as regards the food of the people, how necessary it is to exercise control and supervision; and it is satisfactory to know that not only does science teach the recognition of improper food, but executive sanitary regulations endeavour to

protect them from the consumption of tuberculous or otherwise contaminated flesh or milk—which, unhappily, are far too common—oysters and shell-fish grown up under the influence of water polluted with sewage, etc., as effectively as it does or should do from impure water.

The influence exerted on vital statistics by sanitary science may be seen by reference to the returns of the Registrar-General.

In the birth-rate, however, we find a diminution, especially since 1871–80, when it fell 3 per thousand. It has fluctuated from time to time, but since 1876—when it was 36·3 per thousand, the highest recorded—it has steadily declined, and for the quinquennium 1891–95 was 30·5 per thousand. This must be due to a variety of social conditions, which need not be discussed here.

The great increase in the population is an indication of the increasing prosperity of the country. This, of course, is attributable to many causes apart from sanitation, though, no doubt, improved hygienic conditions have some share in it, as is shewn by the diminished death-rate. The census of 1841 returned the population of England and Wales as 16,049,554, that of 1891 as 29,002,525, and it is still progressing at a similar rate,* and not likely to be restricted whilst the present state of prosperity continues, and the Empire is ever enlarging its boundaries.

One indication of the effect of sanitary work is observed in the death-rate of the country. In 1841–50 it stood at 22·4 per thousand; in 1891–95 at 18·7 per thousand; but for the four years 1890–1893, it had risen owing to epidemic influenza, the lowest rate, 1884, having been 16·6 per thousand. It varies considerably according to locality. In some parts of England where health is the main object considered, it has been as low as 9 per thousand; in others where the chief objects are manufacture, trade, or money-making, it has been 30 per thousand. The death-rate is susceptible of considerable modification, and we know how it may be increased or diminished; it behoves the nation to exert its power and stand credited with the lowest figure. In fact, it is, within certain limits, at our own control, and whether the people shall die at the rate of 13 or 23 per thousand depends on how we recognise our responsibility and put in force sanitary regulations. It is mainly a question of finance. Our sanitarians can say how it is to be done and are perpetually saying it, but more money, more faith, more energy are needed to deal with this question satisfactorily.

* In the Registrar-General's quarterly return for the second quarter of 1898 it estimated at 31,397,078.

The death-rate has fallen proportionately more in the towns than among the rural population. In 1861–70 the town death-rate was 24·8 per thousand whilst the country was 19·7, but in 1891–95 the town rate was 19·5 and the country 17·3—in both cases a diminution but more marked in the urban, probably because sanitation was better in the towns than in the country.

There is a leading article in the *Standard* of June 23rd stating that the death-rate for London, one of the healthiest cities in the world, for the previous week had been 13·8 per thousand, the lowest for five years with the exception of one week in July last year, when it was 13·5. This shows that improvement has taken place of late years, for in 1855 it was 24·3 per thousand, in 1887 it was 19·3, and two years later it was 17·3.

The tendency to migrate to towns no doubt helps to reduce the general health, and it would be well to discourage this as much as social and economic requirements will permit; for a strong and healthy peasantry is more conducive to the national welfare than a weakly urban population.

The registration system came into force the year of the Queen's accession under the auspices of Dr. Farr, and it is since then that we have been able to get accurate vital statistics, upon which depends our knowledge of the state of public health, and from which also we can estimate the mean expectation of life. Statistics show that in 1838 to 1854 the mean expectation of life was for males 39·81, for females 41·85 years. From 1871–80 it had increased to 41·35 for males, 44·66 for females. "When Dr. Farr commenced his labours the mean duration of life in Surrey was 45 years. It was not more than 37 years in the Metropolis and 26 years in Liverpool. Now, the mean duration of life throughout the whole of England and Wales is higher than the first named figures."* Dr. Tatham, in the Registrar-General's report for the last ten years, gives the mean expectation of life for males as 43·7, females 47·2 years. From a comparison of the tables of 1841 and 1881-90, it will be seen that this has increased both for males and females up to the age of 30, but diminished after that age.

Age.	1841.	1881—90.	1841.	1881—90.
20	39·88	40·27	40·81	42·44
30	33·13	32·52	34·25	34·76
40	26·56	25·42	27·72	27·60
50	20·02	18·52	21·07	20·56

* "Practitioner," June, 1897, p. 704.

shewing that though improved sanitation saves more children's lives, the conditions of life being harder as time progresses, the expectation of adult life has become rather less; for the very causes which enabled the weak and sickly to survive have perhaps in the end thus tended to diminish the value of the adult life of such survivors.

It has been suggested that whilst our improved sanitation, our amended condition of living, and our more extended charity have done all this good, and have generally bettered the human race, on the other hand they have prolonged the existence of those who formerly would have succumbed rather than promoted the survival of the fittest. To a certain extent it may be so, but the moral sense insists that the benefit of our knowledge must continue to be exerted in the direction of ameliorating the sufferings, and prolonging the life of the individual as well as of the race.

As to the registration of sickness, to quote Dr. Farr:—"It is true that notification of the chief infective diseases has been secured in the majority of districts; but the wider returns of all sickness treated at the public expense, whether in rate-supported or State-supported institutions, or in hospitals supported by charity, are still left almost completely un-utilised. As Farr said, 'the thing to aim at ultimately is a return of cases of sickness in the civil population as complete as is now procured for the army in England.' By means of such returns 'illusion will be dispelled, quackery as completely as astrology suppressed, a science of therapeutics created, suffering diminished, life shielded from many dangers. The national returns of cases and of causes of death will be an arsenal which the genius of English healers cannot fail to turn to account.'"*

I have already alluded to the benefits that have accrued to the vast population, over 280 millions, of our great Indian Empire, and I trust that a few remarks on the subject may not be considered inopportune. My former connection with India, and the experience derived from observation of its diseases and their effects, in addition to the interest that attaches to whatever concerns the health and well-being of our own as well as the indigenous races, will I trust be accepted as justification for introducing this into an address to a Congress that deals with public health as its chief topic of interest.

The beneficial results of sanitary work have nowhere been better illustrated during the last half-century than in India. Up to that time little or nothing had been done to control disease, or to organise measures upon which public health and

* "British Medical Journal," June 19th, 1897.

the preservation of life depend. The disastrous effects of the want of such precautionary measures on our Army in the Crimea led to the appointment of a Royal Commission to enquire into the sanitary condition of the British Army, and to devise measures for remedying such defects as might be revealed. And here I may say that the result of that Commission was that the mortality of the British Army has fallen from 16 or 18 to 6 or less per thousand. In 1859 this enquiry was extended to India; first to the European and subsequently to the Native Army and jail and civil population. The enquiry having to deal with a large body of men the conditions of whose lives were well known, a vast amount of reliable information was obtained; and it was ascertained as one result of the investigation that the ordinary death-rate of the British soldier had stood for a long period of time at the appalling figure of

84·6 per 1000 from 1800—1830
56·70 „ „ 1830—1856.

It resulted in certain sanitary changes and improvements in the housing, clothing, food, occupation and discipline of the soldiers, which were followed by a signal decline in the death-rate, though marked by fluctuations :—

1886	...	15·8 per 1000	1891	...	15·89 per 1000
1887	...	14·20 „	1892	...	17·07 „
1888	...	14·84 „	1893	...	12·61 „
1889	...	16·60 „	1894	...	16·07 „
1890	.	13·54 „	1895	...	15·26 „

It has been even lower, down to 10 per thousand. Epidemics such as fever, cholera, &c., disturb the regularity of the death-rate, but it is certain that on the whole there has been great reduction of this.

If we roughly estimate the value of a British soldier as £100, a simple calculation will show the amount of gain in the value of lives saved, to say nothing of the suffering and invaliding avoided.

I confine myself here to a simple reference to one form of preventible disease which has recently attracted much public notice, as it seriously menaced the efficiency of the army in India. Its rapid increase was attributed, erroneously, I believe, to the suppression of a Contagious Diseases Act which could only from the nature of things have been of very limited application in that country. But even granting that it may have been to a certain extent concerned, the main causes are to be sought far more probably in the absence of other preventive measures rather within the sphere of military discipline

As attention has been directed to this, as well as to other possible causes, it is to be hoped that the evil may be controlled.

The death-rate of the Native Army does not shew so great a diminution, but here too there is improvement.

In 1889	the	death-rate	was	12·94	per thousand.
„ 1890	„	„		15·91	„
„ 1891	„	„		15·44	„
„ 1892	„	„		14·97	„
„ 1893	„	„		10·29	„
„ 1894	„	„		10·76	„
„ 1895	„	„		11·60	„

Another class about which we have reliable statistics is the jail population, and here the mortality is higher, despite sanitary measures. For example—

In 1889	it was	36·56	per thousand.
„ 1890	„	31·49	„
„ 1891	„	31·89	„
„ 1892	„	36·83	„
„ 1893	„	25·01	„
„ 1894	„	31·87	„
„ 1895	„	27·61	„

The high rate of sickness and mortality in the Indian jails has been a subject of anxious consideration to the Government of India and the sanitary authorities. No pains—I may say no expense—are spared in dealing with it. The abnormal conditions of prison life, and perhaps occasional defects in architectural construction, may in some measure account for it, and the probability is that were not every sanitary precaution rigidly enforced the mortality would be higher than it is.

As regards the vast civil population we have not only got to deal with epidemics, famine and long established modes of living, which obstruct improvement, but also with ignorance, prejudice and religious scruples, which tend to make the natives doggedly resist all measures taken for the amelioration of their condition. They persist in their ancestral modes of social life, resist all changes, and, as we have lately seen, have risen in revolt against the well-meant measures devised by authority for saving them from plague, cholera, and other pestilence. Their indolent habits, prejudiced minds and fatalistic creed all stand in the way, but even the natives of India are being gradually educated into a better comprehension of the value of sanitary measures, and, as time progresses, it is to be hoped that under the firm and judicious administration of the authorities, sanitation may prove as beneficial to them as it has been to others. Though we know that improvement is in progress it is not so easy to shew

by statistics the actual rates of mortality of the vast civil population, because so many disturbing causes exist; and though registration is greatly improved there is not the accuracy and reliability that belong to the returns of the army and jail population, which are all under supervision and control.

Referring to the published mortality returns during the period between 1882 and 1895, they have oscillated between 23 and 33 per thousand. This is after all not a very high death-rate considering the circumstances, but is susceptible of diminution, and this I trust will take place.

Since 1866 a well-organised sanitary department has existed and every effort is made to give effect to its teaching, whilst the ample and carefully constructed reports by the Chief Commissioner, as well as those of subordinate local governments and municipalities, afford ample data upon which to construct preventive measures, and at the same time shew that public health forms one of the most important considerations of the Government.

The annual Report of the Sanitary Commissioner with the Government of India for 1892 shews that out of a registered population of 217,255,655, 4,621,583 died of fevers. Compare this with the year 1895, when out of a registered population of 226,010,428 (note the increase) there was a death-rate from fevers of 4,266,293. These returns fluctuate, but at any rate the figures shew a tendency towards improvement. How much more fatal, fever is than any other disease is shewn by the following figures for 1892:—

Fevers caused	4,621,583	deaths.
Cholera „	727,493	„
Dysentery and diarrhœa caused	234,370	„
Small-pox „	101,121	„

The plague which has appeared in India within the last two years, and has so largely added to the death-rate in certain localities, its modes of invasion, diffusion, and recrudescence, are all being carefully studied, and already it has been shewn to be amenable to sanitary laws like other epidemics; we may, therefore, hope to ultimately control and get rid of it altogether, though there is reason to fear that this will not take place for some time to come.

It is satisfactory to know that the etiology of cholera, plague, and fevers is being carefully investigated by competent observers, and we are warranted in believing that we are approaching the solution of important problems of ultimate causation of disease which have hitherto remained without satisfactory explanation, and the knowledge of which will enable

us to construct our measures for prevention upon an even more assured basis than they occupy at present.

In connection with the subject of sanitation and preventive medicine in India, one may not omit to refer to the names of its great pioneers, such as Ainsley, who wrote as early as 1788 upon measures for the protection of the health of soldiers; Ranald Martin, who was one of the foremost pioneers in India as he was in this country, and to whose initiation many of the sanitary measures now in force in both countries are due; later on J. M. Cuningham, Bryden, Cornish, Hewlett, Ewart, D. Cunningham, Vandyke Carter, Simpson, Manson (China), whose investigations into the causation of malarial fevers have justly excited so much attention; and to these, did time permit, I might add a number of names of younger men to whose admirable work I gladly bear testimony.

I have already noticed the great progress that has been made of late years in the knowledge of the etiology of disease. This is not the time or place in which to describe or dilate on the various steps by which it has been or is being acquired; but one must not omit to acknowledge that its importance in relation to hygiene and as a scientific basis on which to found any rational system of proceeding with regard to prevention as well as cure of disease is incalculable, for without it, although empirical methods may be of some value, no real progress can be maintained.

It is impossible to exaggerate the value of these researches, which have already led to the antiseptic methods of preventing the noxious action of micro-organisms and their products, and to the knowledge of the immunising or curative effects produced by inoculation of the attenuated virus, toxins or antitoxins (blood serum therapeutics), as well as to the aid that has been afforded to diagnosis. Already, indeed, important practical results have been obtained.

I am indebted to Dr. A. Macfadyen, the able Director of the Institute of Preventive Medicine, himself one of the most distinguished workers in bacteriology, for the following lucid account of the progress already made in the application of bacteriological science to the prevention and treatment of disease, and which holds out promise of further advance in this most important branch of science. The successful establishment of the Bacteriological Department of the Institute as well as of that of the Royal Colleges, is an earnest of further development in our own country of a branch of scientific enquiry which is obviously of such vital importance to public health and to those interests with which this Congress is so closely concerned.

"There can be no better memorial to Jenner than to carry on his work in his spirit. The fresh impulse to this was derived from the labours of Pasteur and Koch, who not only demonstrated the part that living agents play in the causation of disease, but also gave us the methods whereby these might be investigated. In this way the foundations of bacteriology were laid.

The main problems connected with the causation and prevention of disease and many sanitary questions are bacteriological in their nature, whilst some of the most pressing questions connected with water and sewage are of a biological character. The soil, air, and water, as well as our food, have to be considered as possible media for harbouring and conveying the living germs of disease.

The question of questions has been that of immunity to disease. We know that animals are insusceptible to certain diseases that affect man, and that the converse holds good. We also know that certain individuals remain unaffected in times of epidemic, though equally exposed to the infection. Further, that recovery from certain diseases protects the individual against a subsequent attack of the same disease.

The attempt has been made to follow nature's methods in the hope of protecting the system from the attack of a disease or of alleviating its symptoms. The discovery of the principle of vaccination for small-pox remained a unique achievement until the successful isolation of the living agents in many infectious diseases rendered it possible to work with greater certainty of success in this field.

The attempt was made to use the modified living virus to produce a mild attack of a disease with a view of protecting the system against infection with the fully virulent virus, *e.g.*, Pasteur's attenuated anthrax vaccine for cattle.

The endeavour was also made to use as a vaccine, substances which no longer contained the living organisms, but their products. Bacterial toxins of varying origin have been experimented with for the purpose, *e.g.*, products obtained from the cultures or the bodies of pathogenic bacteria; as in the case of the cholera and typhoid fever organisms, and more recently the disintegrated bodies of tubercle bacilli.

The results are not yet of a final character, though much hopeful work is being done in connection with cholera asiatica, enteric fever and tuberculosis.

The greatest modern advance in the treatment of disease has been the introduction of serum therapeutics through Behring's labours, which have found their special application in connection with diphtheria and tetanus.

Diphtheria and tetanus may be described as toxic diseases, inasmuch as the general intoxication of the system due to the poisonous products of the diphtheria bacillus or the tetanus bacillus outweighs in gravity the local action of these organisms at the seat of infection. These bacilli when cultivated in suitable media produce the same toxins that they elaborate in the body, and it is these toxins which

are utilized for immunizing purposes. The animal used is usually the horse, which after treatment with progressively increasing doses of the toxin becomes ultimately insusceptible to otherwise fatal doses of these poisonous products. The animal is then said to be 'immune,' in virtue of antitoxic bodies produced in its system through the introduction of the toxins. The blood serum of the immunized animal contains the antitoxic bodies in large quantity, and can, when transferred to other susceptible animals, confer a like protection in virtue of the immunizing substances it contains. The method adopted is appropriately termed 'blood serum therapeutics.' This procedure is technically known as 'passive' immunity, *i.e.*, the animal has not to go through an attack of the specific disease in order to acquire protection.

The bodies that are produced in the course of immunizing a horse, say to diphtheria, are called antitoxins, because they act not so much on the specific microbe as on its products. In the course of an attack of such a disease the human body elaborates similar substances, which are in a certain sense antidotes. If formed in a sufficient quantity a neutralization of the toxins that are being formed by the microbe in the system occurs and recovery takes place. At the 'crisis' nature effects a process of self-immunization. In the older methods it was sought to produce immunity by inducing a mild attack of the disease. In the case of blood serum therapeutics, immunity is brought about by introducing into the system ready formed 'antitoxins' from a previously immunized animal, and the result, if successful, is an immediate one. The immunity is transient however, lasting only a few weeks.

The preparation of such antitoxic serums has only a prospect of success, when the poison to which the fatal effects of the illness are due is known, and can be obtained of an adequate strength for immunizing purposes. This has been the case in diphtheria, tetanus, and snake poisoning, and hence the most encouraging results that have been obtained are in connection with these complaints.

Experiment has shown that an antitoxin can act both as a preventive and curative agent. Thus, in the case of experimental tetanus, the serum from a previously immunized animal when injected into a guinea-pig is not only able to prevent the disease but also to cure it, even when tetanus symptoms have supervened.

It is in connection with diphtheria that the most successful results have been obtained in man. The Imperial Board of Health, Berlin, has published statistics in relation to diphtheria, which deal with 9,581 cases treated in hospitals with diphtheria serum from April, 1895, to March, 1896, and shew that for every 16 cases that recovered 3 died. In previous years before the serum was used there were on an average 6 deaths for every 16 recoveries. The mortality was accordingly reduced by one half.

The diphtheria serum has also preventive properties, and can be used for immunizing healthy persons exposed to infection.

In the case of tetanus in man the results have hitherto not been so satisfactory. This may be due to the fact that the serum has

not been of sufficient antitoxic strength, or because the disease was too far advanced previous to its employment.

In all cases the best results are obtained by the earliest possible use of the antitoxic serum.

The facts that seem proved are, that in human diseases characterised by an intoxication of the system, immunity occurs at the moment of recovery, and that by the artificial introduction of the substances to which this immunity is due it is possible to prevent or cure such infections.

If this be so the present endeavours of bacteriologists are based on Nature's methods, and we can confidently look forward to still greater achievements in the field of serum therapeutics.

Bacteriology has also supplied agents which are of proved value in the diagnosis of certain diseases. Thus *Mallein*, a preparation from the glanders bacillus, is successfully used for the early diagnosis of this disease. *Tuberculin*, a similar preparation from the tubercle bacillus, allows of an early diagnosis of the disease in cattle. An early diagnosis enables one to adopt timely preventive measures, and therein is the great value of tuberculin, inasmuch as we are here dealing with a communicable disease between man and animals.

Bacteriology has also rendered valuable help in the diagnosis of diphtheria and typhoid fever, and medical men and sanitary authorities are now largely availing themselves of this help.

The yearly increase in the work the British Institute of Preventive Medicine is asked to undertake on behalf of sanitary authorities demonstrates how keenly alive they are becoming to the importance of adopting the latest methods calculated to safeguard the health of the community."

Evidently, a great future is before preventive medicine, and we may confidently look to the eminent men of science who are now pursuing with such indefatigable zeal their researches into the mysteries of bacteriology for its fulfilment. But those who admire and appreciate their work the most, and look forward hopefully to its results are anxious that progress should not be retarded by hasty deduction and premature generalisation, which may only end in disappointment.

I venture to suggest that however great may be the importance of the study of bacteriology and the various conclusions resulting from it with regard to the origin, diffusion, and prevention of disease, there are other factors of no less importance to be considered, and it can only be by the study of all these that we can hope to arrive at the complete knowledge which will enable us to fulfil the requirements of sanitary science. Whilst on the one hand it is of the utmost significance that we should be able to demonstrate the actual cause, whether a micro-organism or not, on the other hand it is not of less—nay, from a practical sanitary point of view it is of

more—importance that we should know all the conditions under which this cause becomes effective. It is not enough that we know the seed, but it is necessary that we should also know the nature of the soil, the meteorological and other conditions which determine whether it is to grow and multiply or to remain inert and harmless. If one can learn how to destroy the seed or sterilize the soil in which it attains its full development, or if we can neutralise the favouring conditions and so prevent or impede its growth, then we shall have solved a great problem, and conferred a lasting benefit on mankind.

Much of this has already been done, and the splendid work of Pasteur, Davaine, Koch, Lister, B. Saunderson, Sims Woodhead, and their followers, has added and is almost daily adding to the knowledge which confirms the hope that the consummation so devoutly to be desired will be achieved, that zymotic disease will be minimised, that life will be prolonged nearer to the natural term of human existence, and that man, in short, will no longer be subject to the curse of dying before he has reached the prime of life.

It cannot be doubted that The Sanitary Institute has already done excellent work, and has contributed its share to the advance which public health has made since its foundation. The Spirit of Hygeia is abroad, and measures for preserving health and preventing disease, which at no very distant period in the past were looked on as mere hypotheses, are now, thanks to the teaching of this Institute and others of a similar character, and notwithstanding the obstacles to research arising out of ill-considered sentimental opposition, regarded as of vital importance, and an integral part of the basis of the system of administration on which the public health depends.

I cannot conclude this address without expressing a hope that the proceedings of this Congress now assembled may add largely to the influence of the work of The Sanitary Institute, and widely diffuse the opinions and teaching of the numerous men of science who are associated here and elsewhere in the crusade against insanitation, and in the great humanitarian project of furthering not only the health, but the moral and material welfare of our own country and of all the world.

SECTION I.

SANITARY SCIENCE AND PREVENTIVE MEDICINE.

ADDRESS

By ALFRED HILL, M.D., F.R.S.Edin., F.I.C., Medical Officer of Health and Public Analyst to the City of Birmingham.

PRESIDENT OF THE SECTION.

(FELLOW.)

FOOD PRESERVATIVES.

THERE is a subject of much interest and importance from a sanitary point of view which has necessarily occupied much of my attention, but which hitherto has not received that consideration in our sanitary gatherings which it deserves; I refer to the use and effect on health of certain Food Preservatives, some of which possess additional interest from their comparatively recent introduction, the rapid and enormous development of their application, their chemical composition, and the uncertainty of their physiological effects.

Admitting that the preservation of food is absolutely necessary, we may yet properly consider whether the methods adopted are such as commend themselves to approval or not, or whether certain of them should not be forbidden, or at least strictly regulated.

Besides what may be called the natural preservatives, there is a class of chemical substances called Antiseptics. Their operation varies considerably; in some cases they act simply by combining more or less firmly with water; in others by coagulating albumen which is one of the nitrogenous ingredients of food most prone, in the presence of moisture, to putrefactive change; in others they act by preventing the development of ferments, or by killing any that exist.

Food preservation is naturally an art of very ancient origin, and is common to every country in the world in some form or other. The principal methods for effecting it are by (1) Drying (heat), (2) Smoking, (3) Salting, (4) Sugar and Vinegar, (5) Exclusion of air, (6) Certain mineral or organic antiseptics, (7) Cold.

The necessity for the preservation of food depends on the two facts, that it is in many cases indispensable to store it till wanted, especially for use in the Army and Navy for long expeditions, and even during transport from one part of the world to another; and that from its organic and complex nature it is very prone to decomposition.

Now we know that in order to bring about this change the simultaneous action of four agents is required; water, air, a certain degree of heat and the action of certain micro-organisms. If the concurrent action of these be destroyed by the removal of one of them, decomposition is prevented, and it is on the recognition of this truth that several processes of food preservation are based; for instance, by the process of drying or the removal of water, by the exclusion of air, or by the abstraction of heat and so lowering the temperature beyond a certain point.

Such is the case with articles of food, whether vegetable or animal, but the larger quantity of nitrogenous matters in the latter, and their more complex chemical composition cause them to pass the more readily into fermentation or putrefaction.

The powerful predisposition to change conferred by water is seen in milk and all succulent substances, while with the cereals, containing little water, ordinary careful storage is sufficient for their preservation. The removal of water alone therefore for the preservation of certain kinds of food is very common.

Drying as a method of preservation receives abundant illustration in the vegetables and fruits which so commonly occur in our markets, and are articles of daily consumption; in the stock fish, as dried cod fish is called, and in *Pemmican*, *Charqui*, and *carne secca*, or dried meat of South America and Africa, as well as of northerly regions. In such cases only, or principally, the heat of the sun is taken advantage of. Familiar examples of dried fruits are seen in figs, raisins, currants, prunes, dates, and many other products of the vegetable world.

Sometimes artificial heat produced by the burning of certain kinds of green wood of an aromatic character is used, and in these instances the heat is assisted by the smoke which contains certain antiseptic principles, such as creosote in small quantity.

Smoking is one of the older and more restricted forms of preservation, and like drying and salting is proved by experience to be unobjectionable.

Salting is the most generally employed method of preserving many kinds of food, especially meat, fish and eggs, and, among vegetable substances, gherkins and olives. It is probably also the most ancient, as well as the most universal method.

Besides being a very efficient preservative, salt is a very

suitable one to employ for various reasons. In the first place it is a natural and indispensable ingredient of the animal body which contains roughly about ½ lb. of it, to supply which, an adult takes with his food ¾ oz. a day; it is never absent from the tissues and certain fluids and secretions and is therefore absolutely essential to life; it is indeed to be regarded as a mineral food, as necessary to the constitution and repair of the body as lime or phosphorus, or the organic elements themselves. The salt licks which wild cattle will go miles to visit show how powerful is their instinctive desire for salt, and probably explains why cattle in farm yards will drink the filthy contaminated puddles there in preference to purer water which is equally accessible. Secondly it is agreeable to the taste, an indispensable quality in food, without which it would be ungrateful and indigestible. It furnishes, after decomposition in the body, hydrochloric acid to the gastric juice and the chlorine of the chloride of potassium, which is found in the red corpuscles of the blood and in muscle, while it provides sodium for the soda salts, so characteristic of bile, and for the phosphate of soda always present in the blood. The action of salt in preserving meat is considered to be due partly to the property which it possesses of removing the water and juices, so that it withdraws one of the four agents which I have already enumerated, and the co-operation of which are essential to decomposition, and partly in contracting the tissues and rendering the albumen less susceptible to change; but independently of these actions it is to a certain extent antiseptic in its properties, though not sufficiently so to be injurious, unless used in unmistakeable excess.

I need only mention the effect of sugar in preserving fruits, condensed milk and meat, while vinegar has a still more restricted but perfectly unobjectionable application.

Exclusion of air, with its attendant sterilisation and exclusion of bacteria, is a means of food preservation which has been in use for a long time, and it acts by the withdrawal or exclusion of that elementary constituent of the air which is more or less necessary to the process of decay, viz., oxygen.

There are many ways of effecting the exclusion of air, the majority of them, however, being only imperfect and temporary in their action. For meat, coatings of gelatin or of glycerine or a combination of the two have been employed, of collodion and of paraffin wax. Certain salts having a strong tendency to combine chemically with oxygen such as the sulphites of lime, magnesia, and soda, have been used either in solution or in powder. The sulphite of lime in the latter form is popularly know as "meat preserver" and may be of much advantage in

households in preserving meat for a time in hot weather. Fat in the form of suet and oil is also much used either alone, or together with hermetical sealing in vessels. Fats and oils act mechanically in excluding air, and the latter are much used for preserving sardines and other fish.

But of all the plans adopted for excluding air, the sealing up of food in vessels from which the air has been excluded, either simply or by its replacement by some other permanent and inactive gas, such as carbonic acid, carbonic oxide, nitrogen, or by sulphurous acid, is found to answer best.

The simple expulsion of air by heat and the consequent generation of steam in the vessel and the permanent exclusion of the air by hermetical sealing, receives a very extensive application in the tinning of Australian and American meats which are so abundantly consumed at the present time, and the process is applied also to the preservation of many kinds of food, both animal and vegetable. Its employment does not appear to render meat either less nutritious or less digestible, in which respect it has a great advantage over drying, smoking, or salting, and as far as I know admits of no objection being raised against it. It allows of the meat being flavoured, and if it leaves it cooked, or partly so, this appears no objection, and very often a great advantage, while it has the recommendation of sterilising the substance preserved.

In my capacity of Public Analyst to this city I have necessarily had considerable experience of the adulteration of important articles of food with preservatives, some of which are of quite modern application, I refer more particularly to boric acid, borax, salicylic acid and formic aldehyde, but others are sometimes employed such as sodium fluoride and the sodium carbonates.

During the two years from the middle of the year 1896 to that of 1898, I examined 1016 samples of *milk;* of these 88 were "preserved," 59 by boric acid, and 29 by formic aldehyde. 17 of the preserved samples were otherwise adulterated, and 17 others were of low quality. Probably a larger number would have been found fortified, but of the 1016 samples about 400 were not examined for formic aldehyde. Out of 574 samples of *butter* 216 contained boric acid, and 45 of the 216 borated ones were further adulterated with foreign fat. The *margarine* samples, 33 in number, purchased under the Margarine Act, came out worse than the butters, no less than 28 containing boric acid.

Out of 7 samples of *sausage* 4 contained boric acid, and of 6 samples of *cream* 5 contained boric acid and one of the 5 salicylic acid as well. 4 samples of *bacon* out of 6 were

preserved with boric acid, 4 of *ham and tongue* were all preserved with it, so were 1 out of 3 *pork pies*, 1 out of 2 *pickled meats*, and 1 out of 2 *polonies*. 5 samples out of 6 of *jam* contained salicylic acid.

Of 11 samples of *ipecacuanha wine* 5 contained salicylic acid, 3 were deficient in alcohol. Of 12 samples of *sherry* 1 contained salicylic acid and only 12·4 per cent. of alcohol. The addition to the wines no doubt had for its object compensation for the insufficiency as a preservative of the small quantity of alcohol.

The introduction into food of substances of the character of chemicals and drugs, the action of which is little understood, presents a new difficulty to the analyst, and may constitute a grave danger to public health. The food purveyor is continually seeking to discover new methods for improving the appearance, for preserving the freshness, or for otherwise manipulating the food he deals in. As long as these methods are justified by experience or are known to be harmless, nothing can be said against them, but neither experience nor knowledge can sufficiently assure us on this point with regard to the safety of the preservatives which have of late years come into vogue.

The substance principally used in preserving milk, butter, cream, and meat, is boric acid, or its salt borax, or a mixture of these with each other, and with substances such as common salt. We have to ascertain then what are its effects on health, and though the evidence on this point is not as complete as could be desired, it is sufficient to guide us in forming an opinion.

The British Pharmacopœia includes boric acid and borax amongst its drugs, and gives the dose of the former as ranging from 5 to 15 grains, and of the latter from 5 to 20 grains for an adult. We cannot therefore avoid the conclusion that it is generally regarded as a therapeutic agent capable of exerting a considerable influence on the economy, and boron compounds being foreign to both food and the constitution of the animal body, any comparison between it and salt is altogether untenable.

It has been experimentally shown that boric acid is fatal to the lower organisms, both vegetable and animal; it is also fatal to the higher vegetable organisms. Hötter proved that it destroyed the chlorophyll and so arrested assimilation; the roots by which absorption takes place soon die, and boric acid was found more hurtful than its salts.

Various physiological experimentalists have paid attention to its effects on man and animals.

Mattern found that a dose of 30 grains dissolved in about 2 ounces of water (2 grammes in 50 grammes) induced in him

violent pain in the stomach and diarrhœa, and that doses of 8 to 30 grains dissolved in the same proportion of water administered to rabbits and dogs made them unwell and produced diarrhœa and emaciation, while in some few cases fatal results followed.

Dr. Dixon Mann in his "Forensic Medicine and Toxicology," states that when experimentally administered to animals, boric acid has been found to produce prostration, feebleness of pulse, diminution of respiratory activity, parenchymatous nephritis, cloudy swelling with fatty degeneration of the epithelium, and hœmorrhages under the capsule of the kidney. He states that "Fatal poisoning has followed the injection of solutions of boric acid into natural and abscess cavities of the body. Molodenkow relates two such cases. In one a five per cent. solution was injected into the pleural sac on account of an empyœma; vomiting occurred and the pulse was small and weak, the following day erythema appeared on the face and spread over the body, on the third day the patient died. The second case was that of a boy who half an hour after having an abscess cavity washed out with a solution of boric acid, began to vomit and to be collapsed; erythema and hiccup occurred on the second day when he died . . . death was due to heart paralysis."

He also quotes such authorities as Hogner, Welch and Lemoine, all furnishing similar testimony.

Dr. Mann further remarks that the affection of the skin is one of the most constant signs of boric poisoning.

According to the careful and repeated experiments of Förster and Schlenker, made with a view of ascertaining the effect of boric acid on the utilisation of food in digestion, a daily dose of from half a gramme to three grammes added to human diet affects the absorption of the nutritive substances ingested and probably occasions an increased separation of intestinal epithelia or an increased secretion of intestinal mucus. Förster thinks that borax and boric mixtures will act like boric acid.

It is only fair to say that some authorities consider the amount of boric acid actually required for preservative uses is without injury. Liebreich is one of these but he does not support the view by any experiments, and he does not indicate how only the amount required is to be insured. This amount it is evident may from a variety of causes be easily exceeded.

Dr. Chittenden of Yale University has published the results of experiments with boric acid and borax on dogs from which he concludes that a dosage of 2 to 5 grammes of borax per day, given to dogs weighing from 10 to 12 kilograms, mixed with their food is apparently without effect upon those nutritional

processes which have to do with the utilisation of the proteid food-stuffs. He observed no distinct increase in the amount of fæcal nitrogen, thus indicating that the substance exerts no inhibiting influence on the digestion or assimilation of the proteid or albuminous foods. Nor is the amount of fat eliminated in the fæces influenced to any considerable extent. But he observes that there was an influence upon the urine which had a tendency to become alkaline owing to the rapid elimination of the borax through this channel, and a slight diminution in the volume of the urine.

With larger doses of borax, however, positive evidences of physiological disturbance were found. With dogs of 10 kilograms weight, daily quantities of 8 grammes of borax equal to 1·21 per cent. of the daily food and drink, or nearly 3·5 per cent. of the food alone have a distinct stimulating effect on proteid metabolism increasing the output of nitrogenous matter through the urine. Coupled with this effect is a pronounced tendency to diminish the assimilation of both proteid and fatty foods, increasing the weight of the fæces and their content of both nitrogen and fat. Further, with very large doses of borax there is a tendency toward diarrhœa, and an increased excretion of mucus in the intestinal tract. This latter effect was observed by Förster and Schlenker. The presence of 1·5 to 2·0 per cent. of borax in the daily food is very liable to produce nausea and vomiting.

Dr. Chittenden further observed that boric acid acts in much the same way as borax; it is said that in doses up to 3 grammes a day, it is apparently without influence upon proteid metabolism or upon the general nutritional processes of the body. It has a less disturbing effect than borax upon the assimilation of proteid and fatty matter in the gastro-intestinal tract, the doses mentioned producing no increase of either nitrogen or fat in the fæces. Like borax, however, increase of the dosage to 1·5 or 2·0 per cent. of the daily food is liable to produce nausea and vomiting. It does not, like borax, appear to affect the volume of the urine, nor does it cause it to become alkaline. Its effect on metabolism seems to be similar to that of common salt, *i.e.*, it tends to increase proteid metabolism.

I would remark in reference to the processes of chemical digestion in the laboratory, and experiments on the lower animals, that the conditions are not the same as in the human subject. The chemical experiments outside the body lack the participation of vital action, while the physiological effects on the lower animals are often widely different from those on man. While, therefore, they must be admitted to possess great value, they are not conclusive.

Whatever minor differences may exist among physiological experimenters and others, they agree upon one thing, viz., that even if small doses exert apparently no serious influence upon health, the same cannot be said of large doses. Here then is one great source of danger, inasmuch as it is impossible to control the quantity of the preservative added by one person alone, while there is no guarantee that successive persons may not each make an addition of it to one and the same article of food. A striking case illustrating this repeated addition of a boric preservative is reported by Dr. M. K. Robinson, Medical Officer of Health for East Kent.

Dr. Robinson had to investigate a sudden serious outbreak of illness. Five out of the seven inmates of the house were attacked within a short period of each other. Suspicion attached to the milk which had been taken alone, also with tea and in the form of *blanc-mange*. Both to the morning and afternoon supply the cook had added a preservative which was found to contain boracic acid. A sample as delivered by the dairyman was analysed and found to contain a similar substance. Thus for the same purpose a preservative had been added twice, the result being that an overdose had been administered. To nine fowls was given the residual portion of the *blanc-mange*. Five of them which consumed the larger quantity all died, while the remaining four suffered badly, but recovered. I may remark that this case did not undergo any rigid chemical and bacteriological examination. Dr. Robinson urges that the addition of the drug should be regarded as an injurious adulteration. If such results, he says, can be produced in the case of adults it is not unreasonable to presume that infants cannot take with impunity long continued doses in their staple food. The opinion is general among physiologists that all preservatives, when effectual either from their nature or quantity in so injuring the micro-organisms which bring about fermentation or putrefaction in food as to inhibit their action, also injure those persons who consume such food. If a preservative substance can so influence the protoplasmic integrity of bacteria and other low forms of life as well as of the higher forms like ordinary plants, it is difficult to conceive that the same basis of life-tissue in animals, especially that of the mucous membrane of the alimentary canal, should not also be injuriously affected, to say nothing of those beneficial bacteria concerned in the digestive processes. It is true that it is most difficult to trace the connection between cause and effect in these cases, and also very difficult to determine with precision the degree of the unwholesomeness of preserved foods, but as the preservatives are all drugs or toxic substances, it is only reasonable to require that proofs of their

non-injuriousness under the circumstances of their use be adduced before their use be sanctioned, and that the *onus probandi* rest upon those who use them.

In support of the opinions of the physiological experimenters and toxicologists already quoted I may add those of one or two other toxicologists of eminence. Dr. Stevenson and Dr. Luff are both gentlemen of large and special experience and they are analysts to the Home Office.

Dr. Stevenson in giving evidence for the defence in the Pontypridd butter Case in January last, said the effect of small doses was still *sub judice*. He did not think that an habitual dose of four grains a day would produce any deleterious effect on the constitution except there be some peculiar idiosyncrasies. He thought that ten grains a day—ten to fifteen grains a day—is the maximum permissible to an adult, and that there was no safer preservative than salt. If asked to advise what quantity of boric acid he would allow milk to contain, he replied that he would not allow any to be used, his reason being that it enables milkmen to palm off stale milk as fresh; he had recently stopped its use in a very large establishment.

Dr. A. P. Luff in evidence for the prosecution in a case of adulteration of butter by boric acid expressed the opinion that the equivalent of a little over four grains of boric acid taken daily would prove injurious to health. Whilst constantly taking boracic acid a person would be depressed and mischief would be set up in the kidneys; he would advise the prohibition of the use of boracic acid in food. So much then for the opinion of toxicologists.

On turning to medical practitioners, physicians, and surgeons, we find a pretty general concurrence of opinion on the main question. Some few years ago the Vestry of St. Mary Abbotts, Kensington, was anxious to obtain a definite and authoritative pronouncement on this question of preservatives, which besides being one of great interest to themselves as the body responsible for the freedom from adulteration of the food sold in the parish, was a source of much embarrassment to their able analyst, Mr. Cassal, to whose Reports I am indebted for this information. They, therefore, consulted three of the most eminent medical men of the day with respect to the admixture of boracic acid and its compounds with articles of food.

Sir Andrew Clark made the following remarks: "Seeing that chemical compounds are now widely employed in the preparation and preservation of foods, knowing that many of them, although innocuous in small occasional doses, become in small doses continued over long periods destructive to health; and furthermore believing that many obscure and incurable

disorders are begotten in this manner I regard the enquiry proposed by your Vestry as one of the greatest importance to the well being of the community and certain, if successfully completed, to prove of great public advantage."

Sir Henry Thompson replied "that there was no doubt on the authority of physicians in Germany and in this country that boric acid in what was called 'full doses' was an irritant to the digestive organs, but that it by no means followed that a small quantity should exercise any evil influence whatever. He was of opinion that eight or ten grains to the pint of milk, the amount generally used, would not be injurious to the adult who consumed a pint daily . . . but that on the other hand the infant who was a large consumer of milk, was also much more liable to injury by the admixture of boric acid, being far more susceptible than the adult to the influence of all chemical agents. The proportion named would be calculated to be injurious when taken habitually, certainly to children under three or four years of age."

Sir Henry goes on to say that he "was disposed to believe that the employment of a small proportion of boric acid might be permitted in the milk trade with advantage to the consumer on the following conditions: 1, A declaration of presence or absence of a preservative; 2, A precise statement to be made on a label affixed to vessels containing milk or cream, bearing the name of the salesman, and naming the preservative employed and the quantity added per pint; 3, A similar ticket to be supplied to the retail purchaser; 4, When samples are found to contain more than stated, the salesman should be prosecuted for selling milk which is adulterated, knowing it to be so. Such regulations would ensure to each individual, who might desire to exercise his own judgment, the opportunity of doing so."

The third referee Dr. Lauder Brunton stated that he had no personal experience in the matter, his information was derived from books, and "upon this authority he stated that it was known to be a poison in large doses, and had also been found to be injurious when added to foods."

"The Lancet Special Sanitary Commission on the Use of Antiseptics in Food" last year consulted certain members of the medical profession on the subject. The four questions put were: "(1) Is the presence of small quantities of salicylic, boric, benzoic acids or 'formalin' in food, in sufficient quantities to preserve it, injurious to health? (2) Should the use of antiseptics for this purpose be forbidden by law altogether, or (3) should legislation be brought to bear on the restriction of the amount, or (4) should the law insist that when preservatives are used the fact should be stated on the label?"

Sir Henry Thompson, besides embodying in his reply the substance of his remarks already quoted, said, he entertained "a very strong objection to the dietetic use of any drugs."

Dr. Pavy replied very much in the same strain as Sir Henry Thompson.

Dr. F. J. Allen, Professor of Physiology in Mason College, Birmingham, remarked that "whatever antiseptic may be used, it should be remembered that in order to obtain its due effect there must be enough present to exert a decided influence on protoplasmic activity. This effect can hardly be expected to be beneficial to the tissues of the alimentary canal. Even the disinfection of the contents of the alimentary canal is a doubtful blessing, in most cases because the beneficial organisms are thereby destroyed. However harmless an occasional dose of boric acid (or one of its compounds) may be, it is evident that the case may be different when nearly every article of diet contains it."

Dr. G. Sims Woodhead, after speaking of the difficulty of forming a very definite opinion on the subject, remarked that idiosyncrasy had to be taken into account; salicylic acid, boric acid, and the like may be comparatively harmless in 99 cases out of 100, and yet exceedingly harmful in the hundredth case. We do not know as yet what effect certain of these drugs—formalin, for example, which acts very directly on albumenoid substances—may have upon food stuffs, especially as regards their actual digestibility, and until these points are settled it should certainly be illegal to add them. The last point to be considered is that allowing the use of such preservatives is a direct incentive to the distribution of "doctored" articles of food. Taking milk as an example it is possible, as we know, by the use of chalk and other substances to render sour milk saleable as fresh milk, and it is imaginable that by the addition of chalk and, say formalin, that such milk may remain saleable for some time after it has been "doctored," but no one would convince anyone who has studied the question of milk as a food for children or would contend that such milk is fit for food for any but the most robust digestion. The same theory should be carried into every question connected with food supply.

Sir Benjamin Ward Richardson thought preservatives necessary, also harmless in proper quantities. A licence ought therefore to be given permitting, in every case where it is necessary to preserve, a certain fixed and not dangerous quantity of an antiseptic, and it should be stated on the label what that antiseptic may be and what is the quantity of it used.

Dr. Lauder Brunton's views and recommendations are in line with those of Sir Henry Thompson.

Sir William Roberts concludes that "What is wanted is an enquiry and it would be a very long and difficult one."

Dr. W. D. Halliburton was unable to speak from his own experience, and Dr. Bradbury, of Cambridge, and Dr. Whitelegge expressed similar opinions.

While there is some difference of view expressed in the above replies they are pretty unamimous in the opinion that the antiseptics above named taken continuously in food in sufficient quantity to preserve it are injurious to health. Some would not oppose the use of antiseptics altogether but would place restriction upon the amount used, but they are absolutely unanimous in any case in requiring that the name of the substance added and its amount should be stated on a label attached to the article when delivered to the buyer.

But there are some other points demanding attention besides the four embraced by the "Lancet" enquiry. It is important to consider what would be the effect of a larger quantity of preservative than that which is "necessary" in one staple article of food, and what again if a number of articles of food consumed at nearly every meal contain it. Food purveyors have very indefinite notions on the question of quantity, and while one considers 18 grains of boric acid sufficient to preserve a pound of butter, another uses for the purpose 80 grains; but if 18 grains are all that is necessary, why use 80? For if the former quantity is harmless there is no proof that the same can be said of the latter. Neither is there any assurance that the same article may not be dosed more than once, or that more than one antiseptic may be originally added, both of which cases I and others have known to occur. If a question bearing on these points had been submitted, no doubt the answers would have constituted an unanimous and unqualified condemnation.

From this point of view I can only come to the conclusion that the use of chemical preservatives ought to be prohibited altogether. This is the law in New York, with regard to milk, passed in 1893, by which it was enacted "that milk is adulterated to which has been added or to which has been introduced any foreign substance whatever." There is a brevity, a simplicity and a directness of purpose in this enactment which is most admirable in these days of clauses so constructed that a clever advocate can prove that they mean anything, including sometimes even what they were intended to mean.

France has a similar enactment and in Germany all antiseptics are illegal, boric acid in meat, especially, it having been found to cause gastric derangement. In Belgium also as well as in many other countries as Spain, Italy, Holland, and some South American States, the addition of preservatives to food is

absolutely forbidden. But in England, the first country to pass an Adulteration Act, which I may remind you had its origin in Birmingham, no direct action is taken to prevent the use of preservatives; as such they can only be dealt with as adulterants, injurious or otherwise, under the Sale of Food and Drugs Acts, in the same way as chicory in coffee or alum in bread, or any other ordinary adulteration, so that analysts are placed in the difficult position of having to prove in each case that the substance added is injurious to health, because although strictly it is an adulteration in being foreign in its nature to the article of food, yet so small an amount as half a per cent. or even one per cent. cannot be looked upon as materially interfering with its bulk and so constituting a commercial fraud. This fact has proved a great stumbling block in the way of prosecutions for the addition of preservatives and it is only quite recently and principally within this year that convictions have been obtained at Barry, Salisbury, Pontypridd, Birmingham, Marlborough, Pontypool, Chester, and Llangollen, for the addition of boric acid to milk and butter, while for the addition of salicylic acid to beer, ipecacuanha wine, lime juice cordial, and quinine wine, convictions have been obtained in Burton, Wolverhampton, Liverpool, and Swindon.

In considering this question of small quantities of preservatives, we can scarcely regard them as fraudulently increasing the bulk, weight, or measure of the article. On the other hand we must not confine our view to the injury which they cause by their own direct physiological action, we must bear in mind that they enable foods to be sold as fresh which are stale, and which have undergone such putrefactive changes as to make them frequently harmful, and sometimes actually poisonous.

One of the difficulties in the way of putting down the use of preservatives is the different way in which it is regarded by the bench in adjudicating on these cases. It seems to me that magisterial decisions very frequently hinge on an altogether erroneous application of one of the provisions of the Adulteration Act, and so lead to the dismissal of cases which, if decided on the proper reading of the Act, would result in convictions. I refer to the way in which one clause is made to do duty for another, having a totally different application, *e.g.*, to the action taken especially on Clause 6, while the decision is ultimately given on Clause 3. Clause 3 provides that "No person shall mix, colour, stain, or powder, or order, or permit any other person to mix, colour, stain, or powder any article of food with any ingredient or material, so as to render the article injurious to health . . . . " etc. Clause 6 provides that "No person shall sell to the prejudice of the purchaser any article of food

or any drug, which is not of the nature, substance, and quality of the article demanded by such purchaser. . . . " etc.

Prosecuting authorities believing in the injuriousness of preservatives, but knowing the difficulty of proving injury under Clause 3 of the Adulteration Act, elect in such cases to proceed under Clause 6, which does not require proof of such injury, but only proof that the article contains something "which is not of the nature, substance, and quality of the article demanded." The evidence for the prosecution is not disputed by the defendant, for he knows he cannot successfully dispute it, so he adroitly puts forward the plea that the added substance is not injurious to health, and thus diverts the attention of the bench from the provisions of Section 6 to those of Section 3. To my legally untutored mind, it appears that such a plea should be instantly disallowed because it entirely evades the point upon which proceedings are taken, and introduces another which is not in question. Too often, however, the bench is led astray by the drawing of this advocate's red herring across the forensic trail, the bench straightway requires proof that the substance is injurious to health, a thing which is exceedingly difficult to do, and which the prosecution does not contemplate, and which it has not brought up for consideration; evidence is then adduced by the defence to prove that the substance added is not present in sufficient quantity to be injurious, with the result, often, that a benevolent and sympathetic bench, in the face of conflicting testimony of so-called experts, decides to dismiss the case, and that on a point to which the Clause (6) has no reference, and under the provisions of which the prosecution has not taken action.

Salicylic Acid is by no means so extensively employed for preserving food as boric acid, largely for the reason that it is less soluble and less pleasant to the taste, though it has been largely used on the Continent for preserving milk, and it has been used also to preserve meat and fish; I have found it in cream, in jams, and in spirituous compounds.

Commercial salicylic acid is said to sometimes contain carbolic acid; it possesses irritating properties; its vapour attacks the eyes and it excites coughing.

According to F. D. Simons it retarded peptic digestion, and Chittenden observed that salicylate of soda and borax act antagonistically to the digestive ferment.

Though not very poisonous in moderate doses and in dilute solution, yet in large doses it is said to produce serious cerebral symptoms, and it is well known to medical practitioners to produce in medicinal doses, headache, deafness, singing in the ears, and loss of appetite. French authors especially call

attention to the injurious action in diseases of the kidneys and to its slow elimination in aged persons.

Benzoic acid is another drug that may be classed with salicylic acid. It came into use in France after the suppression of the use of salicylic acid, partly because, according to Hehner, it possesses greater preservative power, and partly because it is more difficult to trace. It has a sharp taste and produces a peculiar irritation in the throat. Professor Salkowski says that benzoic acid possesses stronger antiseptic properties than salicylic acid, and that both are equally unsuited for internal administration as they enter into combination with the soda of the blood.

Sulphurous acid, free and in combination with calcium and sodium, is much used for the treatment of wine and beer as well as for lime-juice and meat. It acts as a destroyer of those micro-organisms which produce the diseases of wine, checks the fermentation and improves the keeping powers of beer.

The question of quantity comes in here as with other preservatives, and while it is considered that small quantities of the acid and its salts are apparently harmless, larger quantities are injurious to health, as shown by Pfeiffer. He found that 80 milligrams (equal to $1\frac{1}{4}$ grains) of sulphurous acid dissolved in sugar and water and distributed over 24 hours was badly tolerated by women, producing diarrhœa, vomiting, and discomfort, lasting over some days. The magnesium and sodium salts were much better tolerated, but Pfeiffer himself and some friends suffered from pressure and pain in the stomach after taking half a gramme of sodium sulphite largely diluted with water.

Fluoride of Sodium is a mineral salt which has been more recently vaunted as not only very efficient but as "absolutely harmless" for the preservation of milk and butter. It is very remarkable that every preservative brought forward is said to be harmless.

Sodium fluoride according to Arthus completely restrained the butyric ferment (microbe) in a solution containing ·4 per cent. of the fluoride, and that ·3 per cent. will restrain the formation of both lactic and butyric acid and that milk treated with this proportion will keep indefinitely.

Experiments made by the Pennsylvania Department of Agriculture showed that while it did not interfere with the action of diastase and some other ferments on starch it completely prevented the action of the pancreatic ferment.

Rabuteau states that 0·25 gramme (less than 4 grains) affected him with salivation, dogs vomit after taking 0·5 gramme, and larger doses produce cramps, paralysis and death.

This is perhaps the reason why we have heard very little about this new preservative agent. It seems to have received its principal application in France as a preservative of wines, for which purpose very small quantities seem to suffice.

Formalin, which is a 40 per cent. solution of formic aldehyde in alcohol, has been recently introduced as a food preservative, and I find it frequently added to milk: Normandy milk is strongly dosed with it according to Mr. Stokes, and on the same authority it is said to have been tried by London dairymen, but to have been abandoned owing to its disadvantages.

What are its properties?

F. D. Simons says that in his experiments it retarded pancreatic digestion, and Weigle and Merkel say that it renders the albumenoids of milk less digestible; an addition of one part of formalin to 500 of milk rendering the casein insoluble in pepsin and hydrochloric acid.

According to Rideal 1 ounce of formaldehyde (equal to 2½ ozs. 40 per cent. formalin) does the work of 5 pounds of borax and boracic acid, so that if a very small addition is sufficient its greater potency makes up for its smaller quantity.

Attempts to preserve fish by means of formalin failed on account of its hardening effect. This was apparently due to the coagulation of the albumenoids, the samples being made so hard as to be rendered unsaleable, even by solutions containing 1 part of formalin in 2,000.

Carbonate and Bicarbonate of Soda have both been added to milk to preserve it sweet, or to neutralise it when sour; the acid would be unpleasant to the taste and would at a certain point cause it to curdle. The acidity results from the decomposition of the milk sugar and its conversion into lactic acid. The soda added combines with the acid, neutralising it, and so preventing its souring or curdling effect. The habitual use, however, of a soda salt is to be strongly condemned, whether it be swallowed as carbonate, or lactate, or a mixture of the two. One of the pleas of persons using preservatives is that they are not seen to produce bad effects, that they are commonly taken as remedies, and are as harmless as useful. But this is begging the whole question, and disposing off-hand of the problem awaiting solution.

If bad effects are not traceable at once, and to single doses or small quantities, no proof is thus afforded that the continued use is harmless. If the substances are used as remedies it must be evident that the conditions under which they are given are totally different. As remedies they are given for a special curative purpose to persons out of health accepting them voluntarily, and they are only used for a limited time; their

dose is carefully regulated; they are given under professional advice and supervision. If mixed with food the conditions are altogether different, there is no curative object, for the consumers are not necessarily ill, they take the substance without requiring it, and involuntarily, without even knowing of it, and for an indefinite time. There is no regulation of the dose, which is found to vary very widely, and the substance is administered by lay persons having no knowledge of its nature or the bodily condition of those made to swallow it.

For the reason that milk is the one perfect food, especially valuable for invalids and children, it is the one which *par excellence* ought not to be tampered with. It is true that milk soon changes, it does not keep indefinitely, and evidently Nature did not intend it to do so. The young of all mammals naturally receive it directly from the mother, and the more directly we obtain it the better. It is only the ingenuity of Man which is exercised to circumvent natural law in this connection, and as long as this is done without medication and adulteration there is no objection, and happily we know a safe means of doing it. It is admitted that the decomposition of milk does not occur in properly conducted dairies under forty-eight hours, which should be long enough to allow of its distribution, and where it is found necessary to add antiseptics to make it keep so long, it is because the treatment of it is careless or dirty, or otherwise bad, so that preservatives are often added to the milk of our dairies to compensate for the faults of its treatment which our supineness only encourages. An argument of considerable force against the prevention of change in milk by added chemicals is furnished by the circumstance that morbid milk, whether by itself or mixed with normal milk very soon changes, and such premature change is of the greatest value as an indication of the unhealthy condition of the milk, and a signal to direct attention to its cause. If the addition of chemicals to food were necessary, some favourable consideration might be given to it, but it is not necessary as is proved by the fact that it is only used to a limited extent.

Butter is brought here from Australia in excellent condition, a distance of about 15,000 miles without the addition of any preservative whatever, simply protected by a low temperature. Is it not an insult to common sense to suppose then that it is necessary to heavily drug butter from Cork, or from the continent of Europe about 200 miles off, and occupying only a few hours in transit? This simple question is answered emphatically in the affirmative by the fact that not all the butter from these places is so drugged, but only some of it.

Out of the 514 samples of butter which I have examined in

the last two years, only 216 contained a preservative—boric acid; if the remaining 358 samples could be made, transported, stored, and sold without a preservative, why not the other 216 samples?

That there is just as little necessity for preserving meat by the addition of chemicals is proved by one gigantic fact, viz., that last year no less than 6,551,280 cwts. of meat were imported into this country from Australasia, the Argentine Republic, and the United States, without the employment of any other means than either refrigeration or freezing, the latter method being employed for the meat sent from the two former countries and "Chilling," or refrigeration only for that from the latter.

This brings us then to the last of the modern methods of food preservation on the large as well as on the small scale, and as it is the last so it is the best. The fishmonger avails himself of it in his ice well and on his stall. It is by its agency that all the perishable food on our great liners is preserved during even prolonged voyages, and it is used in the great food depôts in many of our large towns. In this town tons of perishable food are continually preserved by its action, and where such stores do not exist they ought to be provided. In this way all perishable articles can be kept until such times as they shall be required for sale and distribution.

Formerly the methods of producing cold were complicated and dear, and had many drawbacks, but these have been overcome by means of the alternate compression and expansion of atmospheric air, and thus the production of cold is effected in a manner which is not only easy and efficient, but which is remarkably economical. Cold acts not by killing the organisms that effect decomposition, but only by inhibiting their action, in which respect it differs from heat and certain chemical antiseptics, such as chlorine, for instance.

Among the advantages of preservation by refrigeration may be mentioned

1. It has been proved the most effective as a preservative, surpassing in efficiency salting, boric compounds, or any other practicable method.

2. It adds nothing and subtracts nothing from the article preserved, not even the water, and in no material sense alters its quality.

3. It causes no change of appearance or taste, but leaves the meat or other substance substantially in its original condition, while it renders it neither less nutritious nor less digestible, which cannot be said of some other methods in common use.

My contention is that all additions to food whose influence

on health is doubtful ought to be prohibited, and their use supplanted by refrigeration.

A question of the sanitary importance of the one I have brought before you, interesting as it is in itself, calls for something more than mere consideration; from the sanitary point of view it demands action, a vigorous and sustained effort to obtain reform. Something has already been done in this direction, but it has not been successful. I have already referred to the action of the Vestry of St. Mary Abbotts in May, 1893; the Vestry also put a question on the subject of boric acid in food to the Local Government Board. The reply indicated "that the question was one which the Board have no authority to decide," and they referred "the Vestry to note (*d*) appended to the form of certificate in the schedule to the Sale of Food and Drugs Act, 1875, which also authorises the analyst to insert at his discretion his opinion whether any mixture was for the purpose of preserving the article, and whether it was excessive;" . . . also, "to the remarks on the subject at page 6 of the following extract from the Board's Report for 1890-91." The remarks referred to are as follows:—"It may be noted that the use of boric and boracic acids as preservatives of butter and other substances liable to decompose speedily seems to be finding increased favour among dealers, and is at the same time creating a difficulty for analysts, since it is not always clear in what cases the addition may come within the proviso of Section 6 of the Sale of Food and Drugs Act, 1875, with regard to 'any matter or ingredient not injurious to health' which 'has been added to the food or drug because the same is required for the production or preparation thereof as an article of commerce in a fit state for carriage or consumption.' There is no doubt that boric or boracic acid, if taken in large quantities, would be injurious to health; but we have no sufficient information to show whether such minute amounts as are generally added as preservatives could be regarded as having that effect, and more exact information is wanted before it can be decided whether a process which *primâ facie* may be regarded as intended to prevent the loss of valuable food must be held to be prohibited by law."

It was expected that the Food Products Commission, which sat for several years and took a very large amount of evidence, would have resulted in the furtherance of this question. In their report they say: "Your Committee understand that it would be difficult to prove that some colouring agents and antiseptics are injurious to health, but the opinion has been expressed that some limits to their use should be imposed. Your Committee think the matter is one which deserves further investi-

gation by recognised scientific authorities, with the view to an expression of opinion that may be regarded as authoritative." Among the matters referred to for a decision by the scientific authority or suggested New Court of Reference "may be mentioned such questions as the wholesomeness of ingredients used in the preparation of food, and the legitimacy of the use of colouring agents and preservatives."

I need not say that no amendment of the Adulteration Act has been made, and consequently no such Scientific Authority or new Court of Reference has been established. It is true a Government Bill was introduced during the past session, but it did not get beyond the first reading; it referred only to milk and butter, and left the question of preservatives unaffected.

Having endeavoured to show how numerous, uncertain, and dangerous are the usual preservatives of the bulk of our food, meat, milk, butter, fish, &c., and indicated a simple efficient, and unobjectionable method in their stead—seeing also that the attempts made through the Local Goverment Board, the Food Products Commission, and Parliament itself, to bring about a reform of practice have hitherto failed, I venture to hope that this meeting will think proper to pass a resolution on the subject, and have such resolution forwarded to the proper quarter. I feel that by doing this we shall be making an important contribution to the usefulness of this Congress, doing credit to ourselves as a sanitary body, and conferring a great benefit on the public at large.

SECTION II.

ENGINEERING AND ARCHITECTURE.

ADDRESS.

By WILLIAM HENMAN, F.R.I.B.A.

PRESIDENT OF THE SECTION.

Having been appointed delegate by the Royal Institute of British Architects, and by the Birmingham Architectural Association, as well as having been requested to preside over this Section of the Seventeenth Congress of the Sanitary Institute, forces me to the conclusion that it is recognised I have, in the course of my architectural career, done something to advance the cause of sanitary progress.

The honour thus bestowed has however, cast upon me a duty which I fear I can but imperfectly fulfil; and I must crave your indulgence should I fail to rise to the standard of excellence which has so conspicuously marked the addresses of those who in previous years have occupied this Chair.

Sanitation extends over so vast a field of scientific research that it is impossible for an architect or engineer, now-a-days, actively engaged in his profession, to do much more than watch the rapid developments brought about by many indefatigable workers in numerous fields of investigation, and intelligently to take advantage of the knowledge acquired by others, so as to apply it in the works with which he may be entrusted.

Engineers and architects are then the active agents by whom sanitary science is practically applied in permanent works for the benefit of mankind.

The noblest undertakings of modern engineers are those which tend to secure the health and well-being of communities, such as the provision of pure and abundant water supplies, drainage, irrigation, the supply of gas and electric lighting, the construction of railways, canals, bridges, docks, shipping, and other means of transport by which food and clothing are brought to our very doors, often from distant localities of production, and

by which many are enabled to leave the crowded streets of cities and towns, to breathe the purer air of the sea-side and of country places.

The natural tendency of the human race is ever more and more to congregate and form communities: it is then only by united action and expenditure that health can be maintained. Where, however, such is adequately exercised, statistics will show that vast populations may live within a limited area and enjoy as good, if not even better health, than those in thinly inhabited districts where co-operation as regards sanitary matters cannot so readily be brought about.

Now that walled-in cities are no longer a necessity for protection, there is little reason why overcrowding should exist; there is generally open country around allowing, in most cases, of almost indefinite expansion, so that with good roads and easy means of conveyance from one quarter to another, large communities may dwell together, and by united action secure better health and greater comfort for the many, than is the lot of those living in sparsely populated localities.

It is among these large communities that architects find their chief employment. It is expected of them not only that they will provide protection from the elements in the homes of the people, but that such will be healthy, safe and pleasant places of abode; in addition to which they are entrusted with the erection of numerous buildings of public character, such as Schools, Hospitals, Asylums, places of Worship, Assembly Halls, Hotels, Theatres, Shops, Manufactories and Business premises; in one and all of which the amount of care and attention bestowed upon their design and construction, may very materially affect the safety, health, and well-being of a neighbourhood, and of numerous individuals, perhaps for generations.

It is well to impress this fact upon the public mind on occasions such as these Congresses afford, and to insist that the function of architects is not alone to produce artistic designs and decorations, but by a careful application of sanitary science, a knowledge of natural laws, of the nature and properties of building materials, of the earth's surface on which they build, and of the air we all breathe, so to design and construct the edifices they erect that, without being devoid of suitable artistic expression, they may be convenient in arrangement, safe in construction, free from sanitary defects, or such as might cause bodily hurt, mental trouble, or untimely death.

That the public have not always, and do not even now in every case demand this, must be evident. Too often, through ignorance, or on grounds of false economy and favouritism, is

the apprentice or inexperienced hand employed. Consequently as individuals either cannot or will not take care that safe and healthy buildings are erected for their use, the Legislature has stepped in and by various Acts of Parliament, Local By-laws, and numerous officials, endeavoured to safeguard individuals and communities.

The effect of this system is perhaps as good as can be expected, but it appears to me unduly to relieve many of personal responsibility which it would be better they should bear, and, because of the inflexible nature of all regulations, if strictly enforced, hardships in some cases must result, or where there is laxity, evasion is sure to follow; but the greatest evil is the lack of impartiality in administration apparent in some localities, so that instead of inspection and regulation, there is too often dictation and interference at the caprice of authorities or their officials, who may consider they have a right to interpret By-laws as they please, whether or not safety or health is in question; such action is not for the good of the community, individuals are irritated and sanitary progress is retarded.

Moreover in matters of sanitation there is much yet to be learnt, and there is reason to doubt the wisdom of many regulations which have from time to time been laid down in connection therewith.

There seems to be a law of evolution in sanitation as in many another subject. Consider the degrees of advance in connection with the disposal of fæcal matter. Not so very many years ago every house had its privy, little more than a hole in the ground close to the dwelling, where month after month, excrement was allowed to accumulate; the fluid filth saturated the ground and contaminated the water supply drawn therefrom, while the putrifying solids poisoned the air around. Then came the cess-pool, more or less removed from the dwelling, and the water-closet developed; at first simply a pan down which an occasional bucket of water was poured to convey away the solids, then a water pipe with tap was provided for the same purpose; odours became unpleasant, to say the least, so the D trap was invented and following thereon the pan closet—that filthy retainer of fæcal matter, still unfortunately to be found in many a house. Public sewers for conveying the objectionable matter to a common outfall were extended. Varieties of valve closets were introduced, and next came the "wash-out" pan, with a flushing cistern which, when acted upon, simply lifts the contents of the pan into the trap below until another flush, perhaps hours after, causes it to move on. Now we have the "wash-down" and "syphonic" pans, which at each flush ought to be thoroughly cleared; but the same bodies who are appointed to regulate

sanitary matters in the interests of the community, if they control the water supply, rarely permit more than a two-gallon flush, which generally proves insufficient for the purpose.

How reluctant some sanitary authorities are that we should be rid of our filth and how they have from time to time retarded the natural order of development, notably by adopting such clumsy devices as the pan collecting system. It is in fact only by painful steps that excreta and other foul matters have been expelled from the near neighbourhood of dwellings. Not long since in many districts a "trap" was required at the foot of every soil pipe, where each discharge was stopped on its way immediately outside the house, there it remained until another discharge came to shift it onward. Even now the "trap" is simply moved on to the boundary of the site often but a short distance from the dwelling. I predict the day will come when all such "interceptors" will be banished together with every other "trap" and impediment outside of buildings, then there will be little if any of that half putrescent matter now so often retained about dwellings, creating sewer gases which find their way into our homes or assail our olfactory nerves as we pass along the streets and highways.

Useful as manholes and inspection chambers may be when judiciously placed, there are some localities where their unreasoning multiplication must in time cause serious nuisance; where their number is excessive they retard the scour of the sewer and often become mere cesspools, filth is deposited around the sides, from which sewer gases are generated. Unfortunately large pipes and the excessive employment of traps, manholes, and inspection chambers are the panacea of inexperience in those who undertake sanitary work.

With every house drain of suitable size well ventilated at its highest point by being carried straight up, its full diameter, clear above all windows, with plenty of street gratings for fresh air inlets to the sewers, ample flush of water, impervious and well laid drains and sewers, all untrapped and free from obstruction; sewer gas, now so well known, might become a thing of the past only to be met with in laboratory experiments.

So soon as a drain from one dwelling joins another, according to law as at present laid down, it becomes a sewer, and from that point the architect, as such, has nothing more to do with it. The sanitary engineer then steps in, it is he who is responsible for the design and construction of the many arteries of pipes and conduits by which sewage is conveyed to the outfalls.

Much as architects may have erred in permitting defective construction in drains, others have sinned more deeply in the

matter of sewers. Apart from their general design, the method of construction, and gradients adopted, actual work has too often been defective in execution, so that, instead of aiding the quick removal of solids by water carriage, they have acted as filters or separators, permitting the fluids to escape and soak into the ground or to run off and to leave the solids to fester and become offensive.

I am of course speaking of what has happened in the past—no sanitary authority, architect, or engineer would now think of permitting such defects to occur. Yet, unfortunately, all are not agreed as to the necessity for preventing the formation of sewer gases, or even in accord as to the best methods of doing so, and, strange to say, although some of the "ills to which flesh is heir" have undoubtedly been traced to the action of sewer gas, there are many keen observers who point to the general good health of sewermen and failing to detect the deadly bacilli in its most concentrated essence, infer that after all, sewer gas is but a harmless though somewhat unpleasant guest. Others go less far, and while pronouncing it harmless within the sewers or playing about the streets, will yet condemn it as a burglar and murderer should it enter a dwelling. Notwithstanding this divergence of opinion, and although sewer gas may not on every count have been found guilty, it is undoubtedly more prudent to regard it as a suspect, to permit it no entry to our dwellings and to banish it from the streets and public ways. At the same time care must be taken not to imprison it within the sewers, for then it becomes more virulent and should it find a loop-hole for escape, it may work untold ill.

In other sections during this Congress much will doubtless be heard of sewage disposal, a subject of the greatest interest to sanitarians. A new era with regard to that question may be upon us, if what is now known as the "septic tank" fulfils the promise of its so-far rapid advance in public estimation.

Facility of disposal implies greater possibility of rapid removal from the neighbourhood of dwellings; and if what is claimed for the septic tank proves to be true, a dual arrangement of sewers and storm-water drains will be unnecessary. The periodic falls of rain can then, by means of collecting tanks or reservoirs, be utilised as a constant means for flushing and cleansing drains and sewers; because it is held that, whatever the volume of the effluent, it may with safety be turned at once into the natural water-courses.

Sanitation has to deal with many subjects quite as interesting, if not so savoury, as sewers and drains. Every building we occupy, the houses in which we reside, the water or the fluids we drink, the food we eat, the air we breathe, the clothes we

wear, the work we do, the recreation we take, all exercise their influence for good or ill upon health.

Because some diseases are marked in their characteristics, and frequently become fatal within comparatively short time, their causes are zealously traced, and safeguards are devised. Yet how many continually suffer ill-health, are deprived of full vitality and capacity for useful employment and enjoyment in life, resulting, in the majority of cases I do not doubt, from neglect of sanitary laws. But because the immediate effects are not made apparent, the causes are more or less ignored, investigation is imperfect, knowledge is indefinite, and popular prejudice is often at fault.

Careful and constant observation of cause and effect, together with frequent exchange of the views and ideas of observers and thinkers, may in time elucidate much that is now obscure regarding what is requisite for the health, strength and consequent happiness of mankind "Prevention is better than cure."

Probably the greatest obstacles to the advance of sanitary science are popular prejudice, and the unreasoning adoption of materials, means and methods which may be good under certain circumstances or conditions, but the cause of evils when wrongly applied or employed.

In this connection is the question of the proper use of certain building materials. In most books on building construction will be found advocated, without qualification as a rule, the employment of hard and impervious materials. Popular prejudice catches at the idea that hard materials must be the best and strongest, and those that are impervious must secure dry buildings, consequently the hardest of stone, the most highly pressed bricks and tiles are demanded. In the daily press there is frequent advocacy for the employment of glazed materials for the entire exterior as well as the interiors of buildings, and in a few cases the suggestion has been followed; yet I find there are many observant architects who persist in what they consider better methods of construction, they seek for materials of permeable structure, having surface texture and variegated tones, with which they build in such a manner that, while securing adequate strength, there is no waste of good material. I venture to believe they are rightly aiming at a scientific method of construction, the best suited to secure health and comfort for the occupants.

To go into all the reasons of the why and wherefore would be out of place in an address such as this but broadly regarded, the difference is on a par with clothing oneself now-a-days in a suit of steel plate armour, instead of in good woollen material; the plate armour was of some value doubtless in the days of

hand to hand combat, but even then only employed for the purpose of protection, as a daily garb it would be ridiculous in appearance as well as injurious to health and comfort; whereas a suit of woollen material is serviceable and greatly to be preferred, from this comparison I must leave you to draw your own inferences.

Ventilation is another subject of primary importance from a sanitary point of view; how glibly most people will talk about it, and yet how little is it understood by the general public. Popular prejudice and ignorance too often frustrate the best endeavours of those who have studied the subject and apply the knowledge they have acquired.

Is it always remembered that regulations respecting the width of streets, the height of buildings, the prevention of overcrowding, the proper construction of sewers and drains, the cleansing of thoroughfares, and particularly of courts and alleys (which, by the way, ought not to be allowed to exist if every individual had a proper regard for his own, and his neighbours health and well being); the quick removal of refuse animal and vegetable matter, from within and around dwellings, an ample water-supply for domestic and cleansing purposes, the provision of electric lighting; and many another duty laid upon district authorities, have one and all a direct bearing upon the maintenance of the atmospheric air we breathe in a state of suitable purity, without which efficient ventilation is impracticable?

Fortunately in this country it is possible in most dwelling houses to employ natural means for securing an adequate change of air on almost every day in the year. Yet there is much that an architect may do, by care and forethought, in planning, in the employment of suitable materials, and in devising means so that such necessary change of air within may be brought about in a manner to secure comfort to the occupants. It must however, be remembered that without due care and intelligent attention on the part of the occupants, efficient ventilation cannot be maintained.

In many buildings erected for public use the case is often different. Natural means cannot always be relied on for securing efficient ventilation, because mere change of air is far from being all that is implied by the term. In addition there must be suitable temperature and humidity of the atmosphere, as well as freedom from draughts. To meet these requirements mechanical means must be resorted to.

I venture to point with some degree of pride to one of the largest installations ever laid down, viz., that at the general Hospital in this city, a building erected from my designs. To Mr. William Key I give all credit for devising the engineering

requirements for heating and ventilating that building; but I have no hesitation in saying, and feel sure he agrees with me, that success in such an undertaking is best secured when the architect, having made himself thoroughly acquainted with the requirements by which good ventilation can be obtained, works hand in hand with the ventilating and heating engineer, and designs the building on lines best suited to the methods to be adopted.

Frequent failures there have been in applying mechanical means for securing ventilation in large buildings. It is well to face that fact, and to realise the vast amount of prejudice resulting therefrom. My investigations convince me that such failures result from three primary causes:—

1. Too low an estimate of the volume of air required.
2. Want of efficient mechanical appliances.
3. Want of constant and intelligent management.

With regard to the first, even recent writers upon the subject of ventilation give a change of air three times per hour as a suitable requirement, and many professed ventilating engineers base their estimates on such inadequate provision. One firm had a laudatory article in a sanitary journal (?), recently published, of a newly introduced appliance, by which it is claimed that change of air within an apartment can actually be brought about *once* in every hour.

So long as architects and the public shut their eyes to the ascertained fact that a change of air from seven to ten times per hour is essential for health and comfort, failure must inevitably result.

The perfection to which mechanical contrivances can now be brought, and the ease with which electricity may be employed for motive power, make it practical to secure an adequate change of air within a building, however complicated may be its plan and arrangements.

The internal capacity of the General Hospital, Birmingham, equals two million cubic feet, and provision is made for propelling a total of twenty million cubic feet of cleansed and tempered air throughout the buildings every hour continuously, night and day.

The experience I have gained in this and other buildings, similarly ventilated on the plenum system, enable me to assert without hesitation that, with an adequate expenditure upon a properly equipped installation and careful management, there is no reason why efficient ventilation and warming should not be secured in every public building, with absolute freedom from harmful draughts.

The provision of dwellings for the working classes has for

many years occupied the attention of sanitarians; because, permanently good health cannot be secured in defective dwellings, and unless the health of the largest class is maintained, it constitutes a source of danger to the rest of the community. There are many reasons why homes for the labouring classes are often defective, but there is one reason which more than any other tends in that direction—it is the system of creating excessively high ground-rents.

There is a limit to the amount of rent which it is possible for working men to pay, consequently if the ground landlord is grasping in his demands there is little capital left to be expended on the buildings and therefore, they are scamped. I am no Socialist in the ordinarily accepted sense of the term, but I realise most strongly that the excessive value put upon land for building purposes—particularly that required for the houses of the working population—is a leading cause of bad building, the result of which is impaired health in the community from which the landowner, as well as members of his family may perchance suffer more severely than they would from a slightly reduced income following upon less exorbitant demands for ground rent.

SECTION III.

PHYSICS, CHEMISTRY, AND BIOLOGY.

ADDRESS.

BY G. SIMS WOODHEAD, M.D., F.R.C.P.Ed., F.R.S.E.
Director Research Laboratories Conjoint Board of Royal College of Physicians, London, and Royal College of Surgeons, England.
PRESIDENT OF THE SECTION.

I HAVE been honoured by the selection of your Council to preside over this Section, which, though greatly occupied with theory, may be looked upon as dealing with the very foundation of practical sanitary work. It is therefore my duty, nay, should I not say my privilege, to give a cursory review of some, at any rate of the more important, advances that have been made in sanitary science in recent years.

I wish I had the power to put before you in the form of brilliant epigram or pointed aphorism some of the truths that we have daily to study, to deliver an address that might be destined to become classical, not only because of the patient display of accumulated facts and observations, the logical accuracy of the deductions and the brilliance of the theories put forward, but also because of the concise description and beauty of diction. I can lay claim to little of all this. My one merit must be that I desire to lay before you a plain unvarnished tale, leaving you to draw your own deductions, and fill in the framework of a very incomplete and skeletal structure.

The history of sanitary science might, if we allow our fancy some rein for a few moments, be compared to the history of geology as put forward by its modern exponents. We may at one time have been somewhat inclined to adhere too strictly to the old cataclysmic theories, and to consider that unless some new thing or startling development was announced at every Sanitary Congress, or at every meeting of the British Association, the progress of the preceding year or years had been but little

of which to be proud; the slower processes, corresponding to the mighty but not easily observed workings of Nature, were, and even now too frequently are, passed over as having little significance, and the year is written down as almost barren, though in many ways it may have been one of extreme fertility.

It may appear to be paradoxical perhaps, that it is sometimes necessary to recall the fact that we are not contemporary with all progress, and with all that makes for a healthy and active people. It may be, and no doubt is, true that we are in many ways favoured beyond any of our predecessors, but just as we now regard the luxuriant verdure flanking the river that flows down the broad-based valley as the temporary but ever-recurring product of a soil which is the outcome of multitudinous geological epochs and changes, so we must remember that the sanitary science of to-day is but the logical outcome of the work of many great minds applied to problems under conditions very multitudinous and constantly changing, until in our own time we have the systems of which we are so proud, but many of which in turn must give way, some in details only, some in principle, to those better suited to the conditions of the future, founded not only on what has gone before us, but also upon the experience of the work done to-day.

It should be an encouragement to all of us that we are not working for the present alone, but that each one who makes his contribution to the science of the present is adding his quota to the advancement of the welfare of his successors, and that although our theories may afterwards be overturned or set aside to give place to others founded on a broader basis, no demonstrated fact, no scrap of honest work of any kind done to-day can ever be entirely lost; it must exert some influence on the work and knowledge of to-morrow.

Had there been no Jenner, there could have been no Pasteur, no Lister, no Koch. The same may be said of every man who is working at sanitary science—we should all have been in a sorry plight had it not been for those who have gone before us. Indeed, in this connection I am often reminded of a saying attributed—with what truth I know not—to Professor Tait, that "our greatest plagiarists are our predecessors."

In the short time at my disposal I should like to say something on three subjects. I select three because they are those of somewhat general interest on which I have had some opportunity of forming an opinion, based on personal observation. On certain points we may differ, but I would have you believe that whether my views are the same as yours or not, I hold to them only after being at some trouble to determine

what basis there was for my belief. Each one of us feels that he can speak more authoratively and effectively of that on which he has been personally engaged, and of which, therefore, unless he be very careless and superficial, he has gained some special knowledge, than he can of the work of others however carefully he may follow published details and arguments.

Tuberculosis.

It will suit my purpose best to deal first with a couple of typical examples of the kind of effort that is now being made by those who have charge over the health of the community.

Recently many rapid changes have taken place as regards the light in which we view certain of the infective diseases, but in no two diseases have the changes been so startling, so kaleidoscopic as in tuberculosis and diphtheria.

Twenty years ago the former of these diseases was looked upon as one with which it was almost hopeless to contend with any great prospect of ultimate success, a conviction which is only now being gradually eradicated from the "lay" mind. In regard to diphtheria the outlook was almost equally gloomy up to five years ago. The spread of the knowledge of the laws of health amongst medical men, amongst corporate bodies, public societies and individual laymen had during the last few decades done something to illumine a very great darkness, and tuberculosis and diphtheria were being systematically sapped and mined by most earnest workers, but advance was slow, and many were becoming discouraged.

With Koch's, Loeffler's and Behring's discoveries, however, a new epoch was commenced, the full development of which is even now awaited with the keenest anxiety.

What we know of tuberculosis already has brought home to us the fact that here we have a shield which has two very different aspects. On the one, the dark side, we have the fact that tuberculosis is a parasitic, infective disease, which readily attacks groups of animals of widely different species as soon as these animals are, under certain well-defined conditions, brought into contact with man. Until the *fons et origo* of this disease had been traced by Koch our knowledge of the infective nature of the disease, and of the widespread distribution amongst animals other than man, rendered the outlook still more grave than it now is. Another "quarter" in this dark side of the shield is that after the disease has reached a certain stage there appears to be no possibility of checking its course, whilst we have very strong evidence that, although the specific cause of the disease, the tubercle bacillus, is a markedly pathogenitic

organism, and can multiply outside the body and on dead matter only with difficulty, it can nevertheless remain alive and capable of doing harm for a considerable length of time, and under conditions which are only now coming to be fairly well understood.

On the other side of the shield, however, we have a somewhat brighter picture, a picture which gives us encouragement in carrying on our warfare against this scourge of the human species [illegible] the temperate zone.

In the first place, as in so many of the other specific infective diseases, we now know that there can be no tuberculosis without the presence of a specific micro-organism, in this case, the tubercle bacillus. Only those who have had to fight against shadows and to contend with ghostly and unsubstantial causes of disease can thoroughly appreciate the comfort of having a distinctly concrete if not very massive foe to combat. Even those who are engaged in purifying our rooms, our water supplies and our drains can enter upon their task with greater gusto and therefore with infinitely better prospects of success than was formerly theirs, because they feel that most of the specific infective fevers have for their causal agents fairly well-defined and moderately easily recognisable micro-organisms. How much more must this be the case with the physician or surgeon who is constantly called upon not only to treat diseased conditions but also to advise as to the best methods of guarding and fortifying his patients against the attacks of these very real, though very insidious, foes.

No tubercle without the tubercle bacillus is a statement which might in recent years have given much needed comfort to members of nearly every family in the kingdom, whilst it [illegible] farmers and cattle breeders that only those who know that nearly [illegible] of our dairy, and therefore our breeding cattle, tested with tuberculin react to the test, can appreciate in the slightest degree. This statement means that no member of a tuberculous family need despair of evading the dread enemy of his race. The children of tuberculous parents may be placed under such conditions that they will never contract the disease. They do not inherit tuberculosis from their parents though they may inherit those weaknesses of tissue and constitution which render them peculiarly liable to succumb to the attacks of the parasites that in their parents are doing such damage. Strengthen the tissues, build up the constitution by good food, fresh air and exercise, and whilst you are doing this, place the child under such conditions that the tubercle bacillus can gain no access to it, and by-and-bye there will come a time at which the attacks of the bacillus

are as futile as they are against the child who inherits from his parents all those protective agencies with which healthy individuals are endowed for the warding off of the onslaught of pathogenetic micro-organisms.

Let us take a concrete example—many valuable herds of cattle in this country are so tuberculous and suffer so from "glands," that when the tubercle bacillus was first described and the hereditary theory of tuberculosis still maintained, it was feared that it would be necessary to sacrifice most valuable cattle in order to eradicate the disease, or at any rate to get rid of tuberculous dams. Naturally there was great reluctance on the part of owners to adopt such a drastic measure as the wholesale slaughter of valuable, though tuberculous breeding stock. That such a course was not necessary was maintained by many who did not believe in the hereditary transmission of tuberculosis, and now Bang of Copenhagen has proved by actual experiment that it is possible to obtain a perfectly healthy progeny from tuberculous herds, if care be taken to remove the calves, as soon as they are born, from the tuberculous mothers, and to feed them on milk originally free from tubercle bacilli, or so heated that any bacilli present are destroyed. It will of course be evident that if the womb of the cow is tuberculous the calf may be born into the world suffering from tuberculosis, but that is because the bacilli in the lesion of the womb have made their way into the tissues of the embryo calf. This is not a true hereditary process, it is rather a condition transmitted from the dam to the calf, the bacillus passing directly from the tissues of the one to the other and only in those cases in which the womb is the seat of tuberculous lesions. If the womb be not affected (when it is so affected the calf is frequently slipped—tubercular lesions in the womb being a recognised cause of abortion in cattle) however widespread the disease may be in other parts or organs the calf is not affected, and it escapes the disease altogether provided that it be removed from its dam and protected against the attack of the tubercle bacillus by any of its many channels of invasion. This is a most important addition to our knowledge, for through it we have the assurance that in process of time we should be able to stamp out the disease in cattle if we can only put the rising generations under conditions favourable to the building up of sound healthy bodies and unfavourable to the multiplication, development, or persistence, of the tubercle bacillus. If this is true in the case of cattle, should it not also hold good where the human subject is concerned. Our methods may have to be modified or altered, and difficulties not met with in the case of cattle may here

present themselves, but there can be no doubt that what will ultimately (and from what one can see, ere very long) be done by stock breeders and their advisers will have to be tackled in good earnest by doctors and sanitary authorities.

I may perhaps be allowed to give my reasons for being so hopeful on this score. Early in the present year I received an invitation from the Cheshire Chamber of Agriculture, to deliver a lecture and open a discussion on tuberculosis as it affects dairy farming, stock breeding and feeding. I was astonished and delighted to find that the discussion that followed was not confined to the medical officers of health present, but that country squires, tenant farmers, cattle breeders and butchers, all of whom seemed to have been giving some attention to the subject, came forward to give their experience or to ask for further information. Those speaking not only desired information, but gave evidence that they were anxious to act in conjunction with and follow the advice of those whom they deemed worthy of their confidence. Professor Delépine tells me that he had a similar experience at Keswick, where at the invitation of the Rev. Canon Rawnsley, he delivered a lecture before an audience consisting of farmers, county and other council authorities, and a number of others interested in this question. Quite recently it has been my privilege to listen to another lecture by Professor Delépine, given at Lord Vernon's request, at Sudbury, Derbyshire, where a most interested audience of farmers, medical officers of health, and others, including the Rt. Hon. Walter Long, President of the Board of Agriculture, Sir William Broadbent, President of the Association for the Study and Suppression of Tuberculosis, Sir James Crichton Browne, Professors Hamilton and Boyce, and Drs. Buzzard, Niven and Ransome, and Dr. Livesey, Lord Vernon's adviser in these matters, had gathered. Incidentally, the question of the use of tuberculin was brought up, and the President of the Board of Agriculture (who very properly insisted that the farmers and cattle keepers should not be the only people called upon to take steps for the eradication of tuberculosis, when we are aware that so many other more important channels of the spread of tubercular infection exist) asserted that he had not the slightest hesitation in saying that, once those in authority were convinced that tuberculin was thoroughly relied upon and generally accepted by scientific experts and practical veterinary and medical authorities as an almost unfailing means of making a diagnosis in doubtful cases of tuberculosis, they would empower him to make arrangements for the supply of tuberculin to qualified veterinary surgeons throughout the kingdom for the purpose of testing cattle. Now-a-days unless some fee were

paid along with the cost of the tuberculin the claim on the Treasury would amount to a most insignificant sum, but the weight of the sanction of the Board of Agriculture in such a matter would be so important that the influence of the mere money-grant might be left entirely out of the question.

Every investigator who has used tuberculin as it should be used, and under conditions now much better understood than they were even a couple of years ago, knows that the tuberculin re-action is almost specifically diagnostic; most of those in this room are convinced that whatever may be the value of Koch's tuberculin as a therapeutic agent its value in diagnosis in obscure cases of tuberculosis is almost incalculable, and, I think, we should be greatly strengthening the hands of our veterinary brethren and assisting both farmers and medical officers of health were we to send from this Congress to the President of the Board of Agriculture a resolution to that effect.

Such questions as "Tuberculosis and its relation to meat and milk derived from tuberculous cattle," "The death-rate amongst children from abdominal tuberculosis," "The incidence of meningeal tuberculosis in early life and of pulmonary tuberculosis in later years," "The effect of moisture," "of ventilation," "of light," and of various other agents upon tuberculosis have all been discussed, and the best means of getting rid of this disease have from time to time been brought before this Congress, but I feel convinced that if for the next year or two we devoted our energies to pointing out that wherever there is tuberculosis there must be the bacillus, and then to indicating that the converse may hold good, pointing out the various positions in, and the conditions under which, the bacillus may be carried from host to host, and at the same time combat the notion that tuberculosis is hereditary, and insist that in its early stages it is a most curable disease, we shall be going still further in the direction of creating an intelligent appreciation of what can be done to stop the spread of the disease and bringing comfort to many who at present look upon a certain proportion of their children as doomed to an early death from tuberculosis.

Within the last year or two the medical officers of health of Glasgow and Freebridge Lynn Rural District Council, and no doubt of other towns and districts have drawn up most admirable circulars dealing with the treatment of tuberculous patients, giving both general and detailed instructions for the prevention of the transmission and distribution of the infective material. These leaflets, spread broadcast by the sanitary authorities, are calculated to do an enormous amount of good, not merely as they effect immediate action, but because of the powerful educational influence they must exert upon those

amongst whom they are distributed, and I for one should like to see them adopted by every medical officer of health and sanitary authority in the kingdom, not only in regard to tuberculosis, but also in dealing with other specific infective diseases. With all these signs of deepening interest in this subject amongst all classes, and with the above examples of the efforts made to spread information on the question of the causation and treatment of tuberculosis before us, I am convinced that during the next decade we shall see a marked diminution in the death-rate from tuberculosis, and I hope that this Section will be able to take its due part in bringing about of a consummation so devoutly to be wished.

Diphtheria.

For the last three or four years most of us have been carefully noting the results of the antitoxin treatment of diphtheria. For my own part, I may state at once that I am satisfied that where antitoxin is given early enough and in sufficient quantity it is practically a specific in the treatment of diphtheria. It may be asked, why then does not diphtheria disappear from amongst us? To those who have studied the genesis of the disease the answer is simple enough. Although antitoxin can never take the place of improved sanitary conditions in doing away with the breeding places of the diphtheria bacillus outside the human body, it may be looked upon as an almost perfect protective against the action of the diphtherial poison in the body. As regards the curative action of antitoxic serum, I have little new to tell you beyond the fact that during the year 1897 the death-rate from diphtheria in the hospitals of the Metropolitan Asylums Board fell to a still lower figure than in any previous year, the mortality last year being only 17·5 per cent., a figure that at one time would have been looked upon as absolutely chimerical, taking into consideration the fact that so many of the cases have already been under treatment for considerable periods, and are only sent into hospital either for surgical interference, or because there remains little hope of recovery outside. Amongst cases of post-scarlatinal diphtheria there has been a still greater falling off in the mortality. At one time something like 60 per cent. of the convalescent scarlatinal patients who afterwards contracted diphtheria succumbed. Now under the antitoxin treatment, in one hospital of which I have statistics the death-rate is about 2 per cent., whilst in another nearly 100 cases were treated last year without a single death.

Now, gentlemen, does not all this point in one direction, and in one direction only? Wherever there is an outbreak of

diphtheria the first thing to be done is to inject not only the patient with a curative dose, but all who can possibly be exposed to infection with a protective dose of antitoxin. This is the only logical outcome of the experiments and experience of the last few years. It has been proved up to the hilt that whichever agent, toxin or antitoxin, first gains access to the tissues, it holds the field, except against the attacks of enormously greater quantities of the other. If the diphtheria toxin gets in first and is left unmolested for some time it so makes good its position that it can with difficulty be ousted or neutralised and then only by large quantities of antitoxin, whilst on the other hand small quantities of antitoxin already circulating in the fluids of the body can render innocuous the attacks of comparatively large doses of toxin. Now that antitoxin is so much more potent than it was at one time and that the conditions of preparation and storage have been so much improved, most of the objections to the administration of protective doses have been removed, and the advantages to be gained are so great that I look forward with confidence to the time when this method of assisting sanitary administrators will be received with the favour that it deserves. It is a step which may be taken at once as soon as there is even a suspicion of the presence of the disease, the earlier the better; it is not even necessary to isolate immediately, as all those injected are at once protected. It does not in any way interfere with the carrying out of sanitary improvements, and although it does not ultimately take the place of these improvements it protects the inmates of the infected houses whilst the improvements are being carried out.

In this matter we are much behind our brethren in New York, where, as Dr. Hermann Biggs informs me, they have brought down the mortality from diphtheria at least one half. The whole question of the prevention of diphtheria has to be re-opened. By ventilation and good drainage two things may be effected. All possible breeding grounds for the diphtheria bacillus may be removed and the protective coverings of the body, the epithelium of the throat, nose and lung maintained in as efficient a condition as possible, whilst the cells and fluids in the body which deal with straying and wandering organisms may be kept vigorous and healthy. The presence of the diphtheria bacillus in the throat of a patient should be looked upon first as essentially a means of diagnosis, but then also as a danger signal, for it may be accepted that wherever these bacilli occur in the throat they give indication of two things (*a*) that diphtheria toxin is being continuously formed in larger or smaller quantities and (*b*) that the patient is a source of danger as a centre of

infection to all, especially children, with whom he may be brought in contact.

Bearing all this in mind may we not hope that ere long something like the following routine will be observed in outbreaks of diphtheria. In every suspicious case of throat mischief a swab will be taken and a microscopic and cultural examination made, and then without waiting for the result of this examination, an injection of antitoxin given. Should the case prove bacteriologically to be one of diphtheria, injections will be given to all those (especially children) who have been exposed to the infection, and none of these will be allowed to go back to school or come in contact with other children not so protected until it has been proved that they harbour no diphtheria bacilli in their throats. This rule should apply to patients as well as to those not actually suffering from the disease but with the bacilli in their throat. It may be objected that in certain cases it takes months to get rid of the bacillus from the throat. I have seen one or two cases out of 12,000 examined in which the bacilli have remained demonstrable in the secretions of the throat for eight months. In all of these cases there appear to have been abnormal conditions in the tonsils—hypertrophy, follicular enlargement, &c., but that such cases do occur affords food for very serious reflection, and indicates that we are not even yet sufficiently careful to disinfect throats and isolate for long enough periods, patients who may be dangerous centres of infection long after all naked-eye evidence of diphtheria has disappeared. The isolation of those cases in which diphtheria bacilli persist would, of course, be attended by great difficulties and inconvenience, and it might be necessary to make some special provision for the carrying on of the education of the infected children, but even if this could not be done it is surely a far less evil that the education of a few children should receive a temporary check than that they should prove a source of infection to schoolmates and playfellows.

I believe that by *early injection in all cases which may turn out to be diphtheria* the percentage mortality will be still further greatly reduced, whilst by a combination of protective injection with strict isolation and disinfection of every throat, whether apparently healthy or not, in which diphtheria bacilli are found the incidence of the disease would be enormously diminished. Such has been the experience in New York and such it would be with us. Remember that here universal injection is not necessary, it is merely a precautionary measure to be applied in cases where there is a danger that infection may have been carried before the disease has been recognised, or

before arrangements can be made for the isolation of a known centre of infection. I am convinced that we are not asking too much in this matter, and that given a fair trial the adoption of this system would be followed by a diminution in the number of cases and deaths from diphtheria, such as those who have not gone into the question can have little idea of. It is for you, gentlemen, to bring this home to every individual with whom you have the slightest influence or authority.

The Treatment of Sewage.

At the recent meeting of the British Association at Bristol, Sir Wm. Crookes, F.R.S., in his most able and interesting presidential address, called attention to the fact that in the very near future wheat growing land will be so far brought under cultivation that with the present crops there will be a "shortage" in the wheat supply of the world. On the other hand he points out that by the proper use of nitrates, the supply of which, however, is by no means unlimited, the crops, per acre, could be so increased that for the immediate future we, the wheat consuming races, need be under no very great apprehension that they will starve. The supply of natural nitrates giving out, Sir Wm. Crookes very naturally turns to the chemist and the electrical engineer of the future for an economical method of fixing the nitrogen of the atmosphere in such a form that it may be utilised as food by plants and especially by wheat. But he points out "that there is still another and invaluable source of fixed nitrogen, I mean the treasure locked up in the sewage and drainage of our towns. Individually," he says, "the amount so lost is trifling, but multiply the loss by the number of inhabitants and we have the startling fact that in the United Kingdom we are content to hurry down our drains and water courses into the sea, fixed nitrogen to the value of no less than £16,000,000 per annum."

Compare this with the statement by Mr. Clare Sewell Read, commented on by Dr. Poore on page 103 of his "Essays on Rural Hygiene." "Sewage," he says, "has come to be regarded by all sensible people simply as a nuisance to be got rid of." These statements are both undoubtedly true; how are they to be reconciled? In sewage we have the solid excrement and urine from what Dr. Poore calls "wheat-eating animals;" in these should be, and are contained, most of the special elements necessary for the building up of the wheat plant—probably in the best proportions—could they be readily assimilated. As is well known by farmers, however, the substances in the solid excrement must undergo very considerable breaking down and rearrangement before they are available for the use

of most of the plants. Put this in the ground, but near the surface, and a process of disintegration and oxidation commences and goes on, through which the nitrogen locked up is gradually set free in simpler or more readily assimilable form. Nitrates are produced and plants are nourished.

Dr. Poore has shown that cabbages are capable of extracting nutriment from excrement almost directly, but that wheat is somewhat more fastidious and must have its nitrogen in the specific form of nitrate or ammonia salt. It is of course held that this slow liberation of nitrates, &c., is favourable to the continuance of the manurial action over comparatively long periods, and that the plants are able to assimilate the nitrates as they are formed.

Artificial nitrates put on to the ground may be used up should there be no heavy floods to wash them beyond the roots of the plants for which they are intended, but with such floods much may be lost; the amount lost in this way from natural manure must on the other hand be very small. On coming to examine the process by which this natural manure is broken down, we find that the disintegration takes place best in the upper layers of the soil in which micro-organisms are present in large numbers, and that the longer this soil is used for this purpose the more active it becomes, *i.e.*, the micro-organisms become more active because (1) they increase in numbers, and (2) they become more energetic in the special direction in which they are called upon to exert their powers. We have probably a process of natural selection—in the true meaning of the term—going on. Those organisms that can live best under the new conditions flourish and increase in power and activity, and others which might interfere with their work are gradually ousted. The solids constitute only a certain proportion of the substances of manurial value of sewage. When they can be placed directly in the soil, at once the best and most economical results are obtained. It must be remembered, however, that much of the solid matter in water-borne sewage can never be brought into contact with the soil, except after carrying it for long distances; and water carriage has come to be looked upon as being so easy and so economical that other methods have gradually been discontinued in our large towns. The great objection of this method is that feculent matter is not, under ordinary conditions, broken down in water nearly so readily as it is in the soil; and in all processes hitherto used in the treatment of sewage, the sedimentation, separation, and disposal of the solid matter have not only increased the cost of working, but have rendered the sewage less valuable as manure. The mixture of the urine with sewage

is not open to the same objections. The dilution with slop-water renders urine (which, as Dr. Poore points out, is at least twenty times too concentrated for application to plants) more suitable as a manure. It has been calculated that the daily production of urea by the human race alone, reckoning the quantity excreted by each individual at the low average of 25 grams, is something like 73,500 tons, containing 17,000 tons of combined nitrogen. (The present value of this nitrogen in the form of nitrate of soda would be nearly £1,200,000.) This valuable material cannot however be utilised directly; it must, before its nitrogen can be used, be fermented or hydrolised into carbon dioxide and ammonia, and then to get the full use of the fixed nitrogen it should be converted into nitric acid and nitrates.

It is extremely probable that the organisms (and the enzymes they produce) that bring about these conversions are far more numerous than we appreciate, as this conversion of urea, first into ammonia and then into nitrates, is taking place in all sorts of places and under very varied conditions. It is, however, very frequently going on where it could well be spared, and again in many cases the resulting products are utterly wasted. In recent years some of our best men have devoted much time and energy to the solution of the problem of sewage disposal, not at a profit but without incurring any great loss. Great advances have been made, and last year one of the most interesting discussions at the Congress was that dealing with bacteriolytic sewage beds. Dibdin, to whom we are indebted for his most valuable experiments on coke breeze beds, and his extension of the Massachusetts experiments; Scott Moncrieff, for his addition of the anaërobic bed to the oxidising plant; Adeney, for his experiments on the oxidation of the carbon and nitrogen elements; Cameron, and many others have made valuable contributions to this most important subject.

During the last few months I have had the opportunity of checking some further experiments carried on by Mr. Scott Moncrieff, and I have been delighted to find that the figures obtained by Rideal and Scott Moncrieff as to the formation of nitrates are not by any means exceptional and that there seems to be some prospect that in the immediate future much of the fixed nitrogen in sewage, that at present goes to waste, may in the form of nitrates be returned to the soil and so to the vegetable products, and especially to wheat, for which the demand is likely to increase so greatly in the near future. Every gram of nitrate that can be rescued from sewage will be a clear gain to the community, and the work of the chemist of the future will be so much lightened.

I do not intend to give you any great array of figures, but I may, merely for the information of those who take an interest in this question, give the following:—On five occasions the sewage treated in the Scott-Moncrieff trays was examined as it came from the last tray; and the average amount of nitric nitrogen found was 6·82 parts per 100,000; free ammonia ·23 parts, and albuminoid ammonia ·104. This latter ranging from ·09 to ·135, the free ammonia in all of the samples except one in which it rose to 1·27, was very low:—in this latter sample, too, the nitric nitrogen was the lowest obtained in any of those examined, 5·349 per 100,000. It would be a simple matter to calculate the amount of nitric nitrogen that might be recovered from the Birmingham sewage alone. I leave this, however, to those who have the necessary data at their disposal. The great fact brought out is that Pasteur, when he insisted upon the specific activity of different groups of micro-organisms and the power they possess of taking up putrefactive and fermentative processes at different stages and each of carrying the disintegration of organic matter a step further, had grasped the whole secret of bacteriolysis. After studying his work and that of his school I wrote the following passage in 1890, and I believe that what was then written may to-day stand *verbatim* as an accurate description of the *mineralisation* of organic matter:—

"It would appear in fact as though there were developed special organisms for the setting up of special fermentations, and also that after the breaking down has been carried a certain length by one organism, the aid of another is invoked to complete the process more thoroughly and more expeditiously. We have in this, as in the case of the process of digestion, an exemplification of the fact that nature economises her resources as much as possible: she does not call on the animal cells of the alimentary tract to do work that can be equally well done by micro-organisms, nor does she demand the exercise of more than one or two functions from each of the protoplasmic specks that we call bacteria. To each one is assigned its special work, and though it is possible that many of them started with certain powers in common, it seems that through the exercise of some of these common powers under special conditions they have become so differentiated functionally, that, as amongst organisms more highly developed, each is able to carry on its own work best at those special stages of the putrefactive process at which it is found. It might at first sight appear that all this can have but little bearing on any practical work in which we are engaged, or in which we take an interest, but on more careful consideration it will be found that these putrefactive organisms really keep up the circulation of matter, utilising the excretions

of living beings and the carcases of dead animals and plants, after breaking them down into their simplest constituents, to supply those elements that are necessary for the nutrition of plants, allowing them to present themselves in their most assimilable forms, and in the proportions most suitable for the nutrition of the growing, highly organised vegetable protoplasm. Bacteria in fact serve to transform inert organic matter into organic substances. This transformation or '*Mineralisation*' in most cases commences only after protoplasm has lost its vitality, and most micro-organisms are capable of attacking this dead protoplasm only; though, as we shall find later, a certain number of bacteria have acquired the faculty of being able to attack even living protoplasm. The process of decomposition may be divided into two kinds; first, those going on as the result of the activity of organisms that are capable of taking up their oxygen from the air, and, second, those the result of the activity of organisms that so break up and re-arrange the organic molecules containing oxygen, that not only do they, the bacteria, take up oxygen themselves, but they allow of its being handed on to the product, to which in their processes of metabolism they give rise. It is probable that here we have to do, not only with nascent oxygen, but that we have certain products set free during the process of decomposition which seize upon oxygen with very great avidity. This decomposition or re-arrangement is spoken of as a process of nitrification or a conversion of the nitrogenous elements into ammonia, nitrous and nitric acids, carbonic acid and water, or speaking more generally, it may be said to be a process of mineralisation of the organic forms of nitrogen, phosphorus, carbon and hydrogen, during which they become finally oxidised or mineralised to nitric acid (HNO_3), phosphorus acid (H_3PO_4), carbonic acid (CO_2), and water (H_2O). In nature this process goes on in the superficial layers of the earth or in the presence of the atmosphere. That it takes place much more readily near the surface of the ground and in porous earth can easily be understood, if what takes place in the oxidation that goes on in spongy platinum is borne in mind."

We are sometimes in our search for truth discouraged by our apparent want of success, or we are embarrassed by the croakings and moanings of men who after doing good work and advancing to a certain stage have stopped, perhaps discouraged by want of apparent success, or, it may be, having no longer the energy to continue a work well begun. Advances in sanitary science will outlast the longest lived amongst us, and we may well be anxious if we can no longer carry the torch, to hand it on to those who have strength and ability to carry it beyond the heights to which we have been enabled to

attain. Let us remember the story in the Arabian Nights—that ever flowing fountain of pleasure and allegory for children of all ages—of the prince who went in search of the singing waters. When he came to climb the hilly road up which he must travel to be successful in his quest, great rocks and ponderous stones appeared to spring up in his path, and voices, seeking to discourage him, tried to prevail upon him to return. The obstacles overcome and a deaf ear turned to the cries, he was at length successful in his quest; then a spell was broken, the stones were turned to men from which the voices had come—men, every one of whom had started out to seek the same waters, had reached a certain height, but had then failed and attempting to turn back had immediately become fossilised into obstacles to further progress up the mountain. Had they continued to fight, however feebly, and to advance, however little, they might still have encouraged those younger and more energetic than themselves, and by offering them their own experience have enabled them to start at the point at which they themselves had arrived.

It is one of the great features of the age and the race to which we belong that much of the work to which men apply themselves is of such a nature that every step brings the worker to a point from which a further advance may be made.

For three hundred years now, men's thoughts and minds have been turned to the study of the great forces of Nature. Art, Literature, and Literary Philosophy, if we may so speak, are in themselves no longer sufficient to occupy the minds of men, or to develop to the full the vigour and alertness so characteristic of present day workers.

As Sir William Roberts so ably pointed out in his Harveian Oration on "Science and Modern Civilisation", delivered in 1897, "wherever we look—in all ages, among all peoples—we encounter the same story with regard to that large and varied and most precious outcome of the human mind, which may be grouped under the categories of the fine arts and literature. There is a history of improvement and growth up to a certain culmination or phase of maturity. Beyond that point no further growth seems possible, but rather, instead, a tendency to decline and decadence." "The evolution of science," he goes on to say "differs fundamentally from that of literature and the fine arts. Science advances by a succession of discoveries. Each discovery constitutes a permanent addition to natural knowledge, and furnishes a post of vantage for, and a suggestion to further discoveries. This mode of advance has no assignable limits; for the phenomena of nature—the material upon which science works—are practically infinite in extent and complexity. Moreover, science creates while it investigates;

it creates new chemical compounds, new combinations of forces, new conditions of substance, and strange new environments—such as do not exist at all on the earth's surface in primitive nature. These new natures as Bacon would have called them, open out endless vistas of lines of future research. The prospects of the scientific enquirer are therefore bounded by no horizon, and no man can tell, nor even in the least conjecture, what ultimate issues he may reach." Our poets, artists, and philosophers of to-day are no greater than those of China, of Greece, or of Rome. We have no greater than Milton or Shakespeare now with us who can improve on the masterpieces of byegone ages. But the youngest student of natural and physical science has at his disposal a basis on which he can form, and material from which he can build up a structure that fifty years ago could only have been dreamed of.

We have received a bright inheritance. It rests with us to hand it on, not only untarnished, but with an added lustre, to our successors.

CONFERENCE OF MUNICIPAL REPRESENTATIVES.

ADDRESS

By Alderman W. Cook, J.P., Chairman of the Health Committee of the Birmingham City Council,

PRESIDENT OF THE CONFERENCE.

I feel that my first words must be to heartily endorse the warm welcome which, on behalf of the city, the Lord Mayor extended to the Congress. We have been looking forward with much interest to this meeting, and I trust it will rank as one of the most pleasant as well as one of the most profitable in the history of the Institute. As to the value of meetings of this kind we are all agreed. The difficulties that confront us in our municipal work are pretty much the same in kind, if different in magnitude, throughout the country. To take counsel together, to freely exchange opinions upon our work, must therefore be very helpful. I know from experience that it may sometimes be a considerable saving of money to a town to know what has been done in a particular direction in other towns. If experiments have been tried in one place why should other towns travel over the same ground when they can learn from their neighbours' experience, and begin at a point which perhaps has only been reached after years of trouble and considerable expense? We owe it to the ratepayers of this country that we should assist one another in every possible way, and from considerable knowledge I can say that I believe that every town in the kingdom acts on this principle. Go where one will in search of information, one meets with the utmost courtesy from members of Councils as well as officials. Every facility is given one to pursue enquiries, and information is freely placed at one's disposal. This is as it should be.

You will have an opportunity while in Birmingham of seeing something of our municipal undertakings. The special department of municipal work to which my attention has been chiefly given has been the Health Department. The sanitary history of Birmingham may be said to have commenced with the appointment of a Medical Officer of Health and a Health

Committee for the first time in 1873. Up till then little attention had been paid to sanitary matters, and the condition of the town was decidedly bad. The death-rate in 1873 was 24·8 per 1000, in 1874 it was 26·8, and in 1875 it was 26·3, while for the five years 1873–77 it averaged 24·8. At that time there were 60 miles of streets and roads which were not sewered, and only four miles of road surface out of a total of 190 miles were properly paved. The drinking water was largely obtained from shallow wells, almost all of which were badly polluted, and a large part of the closet accommodation was on the ashpit-privy system. In certain parts of the town there were a large number of old and crowded houses, and very little was done to prevent the spread of infectious diseases.

Immediately after their appointment the Health Committee set themselves to remedy these insanitary conditions, and their efforts were followed by a great fall in the death-rate. I have already said that for the first five years after their appointment (1873–77) the death-rate averaged 24·8 per 1,000. In the next five years it was 21·6, a reduction of 3·2 per 1,000, and in the succeeding five years it was further reduced to 20·7 per 1,000. The zymotic death-rates for the same periods were 5·3, 3·8, and 3·2 per 1000 respectively, showing a corresponding improvement. At the present time out of 262 miles of streets, we have 33 miles paved with granite or wood, and 8½ miles partially so paved. The remaining ash-pits, a large proportion of which are in the recently added parts of the city, are being gradually abolished. The number of water closets is over 50,000, and of pan privies over 30,000. A large number of old and unhealthy houses have been demolished, and extensive provision now exists for the isolation of cases of small-pox and scarlet fever, and for the disinfecting of houses and their contents.

The refuse disposal in Birmingham is conducted partly on the conservancy system and partly on the water carriage system, the latter having been for many years past the only system allowed for new buildings. The sewage of the town is dealt with by the Birmingham Tame and Rea District Drainage Board, which was formed by Provisional Order in 1877. The Drainage Board area comprises a number of surrounding Urban and Rural Districts as well as the City of Birmingham, the total acreage being 47,624. The population last year was estimated at about 725,000. The dry weather flow of sewage is about 22,000,000 gallons per day. The rateable value is about £3,000,000. The system of purification adopted is precipitation in tanks, and subsequent irrigation.

The chemical used is lime, and is for the double purpose of

assisting precipitation in the tanks, and for neutralising the acids that are discharged into the sewers from the various manufactories in the District. During last year the quantity of mud arrested in the tanks was 326,000 cubic yards.

The area of the Boards' farm and works at present in use is about 1,240 acres, but an Act was obtained last year authorising the Board to acquire and lay out for sewage purposes, various additional lands whereby the area will be practically doubled.

The dry refuse and excreta from pan privies and ashpit privies are dealt with by tipping, by sale as manure, or by burning in destructor furnaces.

The water supply of the town is at present derived from streams and deep wells, being well filtered before delivery, but the Corporation is now engaged in obtaining a more abundant supply of water from Radnorshire.

The public hospital accommodation comprises a well equipped scarlet fever hospital with about 300 beds in a fairly populous district, and a modern small-pox hospital with over 100 beds in a sparsely populated suburb, the disinfection of articles of clothing and bedding is carried out by means of superheated steam. It is satisfactory to reflect that practically the whole of the small-pox cases and 80 per cent. of the scarlet fever cases now obtain treatment at the city hospitals.

From the few facts that I have placed before you, it will be seen that during the past 25 years a vast amount of time, thought, and money have been expended in improving the condition of this city. During the whole of that period I have had the pleasure of being associated very closely with the work of the Health Department, and I look back upon it with the utmost satisfaction, for I am convinced that large as the expenditure has been, the return for it has been far larger, and the increased healthiness, happiness, and welfare of our city has provided an ample recompense to all who have given their time and thought in its interests.

Much yet remains to be done in Birmingham, as in other places. Evils that have been growing up for generations cannot be overtaken in a day. If we could start and plan a town, as we do a hospital, we might do something fairly satisfactory, from a sanitary point of view. But our large towns have grown up without system, without much sanitary control, and we have to take things as they are and make the best of them. One thing strikes me as very important in connection with sanitary progress, and that is that the people generally should be taught to expect a high standard in public work, and that they should be informed as fully as possible on simpler sanitary matters.

In many things we cannot act in advance of public opinion, and if progress is to be obtained, then public opinion has to be educated to the required standard. In this connection it seems to me that popular health lectures such as those which in Birmingham are delivered under the auspices of the Birmingham and Midland Institute and the Athletic Institute are of great service. There are other things that might have been touched upon, but my primary duty is to preside over this Conference, and not to detain you unduly with my own remarks. I think I may for all of us who are engaged in public work say that we regard it as an honour to be so engaged. We realise its importance; we feel that there is room in it for the best energies of the best men, and that to have had only a small part in improving the surroundings of the people amongst whom we dwell, and thus making their lives better worth living, is something to be thankful for.

You will have in your hands a list of the subjects that will come before us.

I trust that we shall all derive profit from the consideration of them, and gather some information which it may be possible for us to translate into practice for the benefit of the Constituencies we represent.

CONFERENCE OF MEDICAL OFFICERS OF HEALTH.

ADDRESS

By John C. McVail, M.D., D.P.H. Camb., F.R.S.E.

PRESIDENT OF THE CONFERENCE.

THE MEDICAL PROFESSION AND THE STATE:

Their Relationship, especially with regard to Vaccinal Legislation.

It had been my purpose to-day to address you on a subject different from that which appears on the agenda paper, but, in deference to a suggestion, I shall devote the half-hour at my disposal to some considerations (most of which are not now urged by me for the first time) bearing on the relationship of the medical profession to the State, especially with regard to vaccinal legislation.

In such a meeting as this, the subject can perhaps be best approached by referring to the relationship of medical officers of health to their local authorities. As is so well urged by Dr. Alfred Ashby in his article in Stevenson and Murphy's Hygiene, the medical officer must be prepared from time to time to submit with equanimity to the rejection of any advice he may tender to his local authority, however sound such advice may have been; nor must he be too sensitive in the event of his advice or actions being misunderstood or misconstrued. He must bear in mind that the decision of his local authority may have been subject to considerations which had no weight with him. It is, however, his duty, if he finds that his advice is systematically and persistently ignored, and that the health of his district is likely to suffer, to repeat such advice, again and again if need be, firmly but dispassionately. He should further endeavour to look at all questions not merely from the view point of the specialist in public health, but also from that of the local authority, and of the owners and occupiers of premises, and of the public.

Of course, the medical profession is not related to the State

so closely or directly as is the Health officer to his local authority. The profession is not paid out of public funds in the same way as the public health service is. Yet the analogy carries far. The Medical Acts which, directly or indirectly, demand a high standard of attainment before a name can be placed on the Medical Register, and which set apart those so registered as the only persons legally qualified to fill many offices and perform many functions, bring us, as a profession, into very close relationship with the State, and give us in great measure the position of advisers regarding the means to be used by the State for the prevention of disease and the improvement of the physical well-being of the people. This is a position, indeed, which the profession has not hesitated in many circumstances to assume as its own. A clear distinction should, of course, be made between this professional position and our individual position as units in the general community.

If there is anything in the analogy which I have ventured to draw, then it is our professional duty to declare with no uncertain voice, and to repeat as often and as urgently as may be necessary according to the greatness of the emergency, our deliberate judgment on methods of disease prevention and health conservation. But it would be a mistake to assume that our conclusions, though their truth be demonstrated and be freely acknowledged by the Legislature, shall necessarily be embodied in Acts of Parliament, and, in their practical application, be enforced by pains and penalties.

Let us apply these considerations to the question of vaccination.

Speaking to an audience of Health Officers—speaking especially after some 1,100 of us have testified by signed declaration that vaccination and re-vaccination prevent and control small-pox, and that small-pox cannot be effectually prevented and controlled without these means—I need not spend time in urging the value of the Jennerian prophylaxis. But, for the present purpose, I shall assume further that the Legislature is equally convinced, (1) that small-pox is a disease which ought to be prevented, (2) that it can be safely prevented by vaccination and re-vaccination, and (3) that it cannot be prevented by any other known means. Does it then unavoidably follow that vaccination should be compulsorily enforced? Can nothing be conceived capable of justifying Parliament in refraining from enacting a power of absolute coercion? Small-pox is an evil—a very terrible evil—but there are other evils besides small-pox, and it is sometimes necessary in mundane affairs to make a choice of evils. Let us suppose that parliament is, rightly or wrongly, of opinion that in many

places in England, the opposition to vaccination is so deep-seated that its attempted enforcement could be carried out only with the aid of an army of soldiers, or would involve the wholesale imprisonment of large communities. Surely in such circumstances parliament is right in endeavouring to weigh and measure the two evils and to choose the less. It may make a wrong choice, and the country may have to pay for the error, but the medical profession has no need to feel injured or aggrieved. The crucial fact is that the decision of such matters is a function of the legislature, and of the legislature only, and where the duty is, there the responsibility must rest. The words "expediency" and "opportunism" are not popular. They are apt to suggest the attitude of Bunyan's Mr. Facing-both-ways. But opportunism may after all be the truest statesmanship, and the man who supports a temporary relaxation of a compulsory law may be the best friend of the administration of that law.

In Scotland we are, so far, in the happy position of not requiring this measure of expediency. The vaccination default, instead of being over 30 per cent. as in England, is less than 3 per cent., and in spite of the Anti-Vaccination war cry having been raised in two or three places within the last year or two, we can, I think, afford to wait and watch the result of your five years' experiment in England. Even in Scotland, however, it is very doubtful if parish councils will be wise in inflicting repeated penalties, and I trust that they will use much discretion in considering the likely effect of prosecutions on the practice of vaccination in their districts. The object should be, not to prosecute, but to vaccinate.

Let it be understood that in all this I am not discussing in concrete fashion the merits or demerits of the new Vaccination Act, nor is it my purpose to do so here. In this meeting we are probably all heartily agreed that re-vaccination as well as primary vaccination requires legal provision; that sanitary authorities instead of poor law authorities should have charge of vaccinal administration; that all required vaccination prosecutions should be conducted not by local authorities but by public prosecutors; that vaccination certificates of private medical men should be payed for by the State as are similar certificates by public vaccinators; and that all vaccination certificates should place on record the area and number of marks. These points and others, however, have been discussed very fully in the medical press and elsewhere, and need not detain us, especially as there is good reason to hope that next session of Parliament will see the introduction of a Re-vaccination Bill.

Regarding the conscience clause we may, as a profession, be satisfied that our withers are unwrung. In this country vaccination though called compulsory has never been compulsory. The whole question is between one degree of pressure and another. The greatest pressure has been by repeated penalties. Imprisonment for non-vaccination has never taken place. It is the common law of the land that in the last resort people who refuse to pay legally-inflicted fines may be imprisoned, but that applies to fines for infringement of the Vaccination Acts in the same way as to fines for the infringement of other Acts. Therefore I say repeated fines have been the maximum legal pressure ever brought to bear in favour of vaccination. Limitation in the number of money penalties means simply a less degree of pressure. The recognition of what is technically-called conscientious objection is assumed by most people to be a further step in the same direction. Whether it will really turn out to be so, time alone can tell. Under the old system vaccination had within recent years come to be a matter of local option, and in many places where the option went against vaccination, no pressure of any kind was brought to bear on individuals. But under the new law Mr. Chaplin has indicated that where Boards of Guardians fail, the Local Government Board will see that the subject is definitely brought before parents, and that if the visit to the Petty Sessions is not made within the stipulated time, the law and the penalties attached thereto will be enforced. In fact, individual option will take the place of local option, and it would be rash to prophesy that under the new system the vaccination default will be greater than, or as great as, under the old.

If all legal or artificial pressure were abolished, there would come into force increasingly the strongest natural pressure—that of small-pox itself. It was the world's intimate knowledge of the dreadful power of variola, and its quickly gained experience of the counteracting power of vaccinia, that brought about the wide triumph of the preventive in the early part of this century. It may seem paradoxical, but there is a sense in which it is correct to say that the growing neglect of vaccination is the greatest centenary tribute to the memory of Edward Jenner. A century ago everybody knew and dreaded small-pox. Now-a-days not one man in a hundred has ever seen the disease, and the public acquaintance with history is not so intimate, nor its imagination so realistic, as to provide a motive equal to that which was furnished to our forefathers by everyday experience of the pestilence. It is not surprising that many parents should hesitate about having a sore place made on their baby's arm in order to guard against

a danger which is no more than a name to them, the very name conveying only the vaguest meaning to their eye or ear. The laws of this country are made by the representatives of a very imperfectly informed public, and though the representatives themselves are, on the whole, much better informed than the represented, and are no doubt genuinely anxious to give to the nation the advantage of their wider knowledge, they can go only a certain length in benefiting their constituents against their will. Democracy and autocracy has each its advantages as a form of government.

Not but that democracy in some countries adopts methods which even an autocrat might be tempted to envy. A free reading of Dr. Rauch's evidence before the Royal Commission may be given in illustration. Dr. Rauch was executive officer of the Illinois Board of Health. In his country there is no law of compulsory vaccination. Everybody is at liberty to remain unvaccinated if he pleases. In 1882 there was great risk of introduction of small-pox into the State of Illinois by immigrants. A meeting was called of the authorities of the different States, and the National Board of Health was asked to require the vaccination of all immigrants. Pressure was brought to bear on the steamship companies and on the health officers at the ports. Very much was done in this way, and it was supplemented by examination of all immigrants in course of transit by railway. Certificates were required of vaccination on board ship, and the arms of those thus certified were examined on board the trains during the railway journey. If the result was unsatisfactory the operation was again performed. In these ways many thousands were vaccinated. One day three Englishmen objected. Dr. Rauch was on the train. He explained to them that he wanted them vaccinated. They asked if vaccination was compulsory. "By no means," he said, "this is a free country." "Then we won't be vaccinated." "All right," he replied, "when we get to the border of our State I'll let you off the train." "But we don't want off." "Just so, but we won't have you in our State. We are a free people and will exercise our freedom in keeping you out." Then the three Englishmen got vaccinated—voluntarily, of course. In the same way the executive of a free people issued an order for the vaccination of all the children both in public and private schools. All the railway employés throughout the State were vaccinated or re-vaccinated, and also the employés of all the manufacturing and mercantile establishments. In one mining town there was much small-pox, and Dr. Rauch determined on general vaccination and re-vaccination. Here are question and answer as given before the Commission. Dr. Rauch says:—

"I issued an order to that effect, and it was enforced in an indirect way. Those who were vaccinated and re-vaccinated were permitted to leave their houses, but those who would not be vaccinated or re-vaccinated were compelled to remain inside of their houses. This is the way that I have acted in a number of instances, and the result has been that of immediately stopping the epidemic." (Q). "There is no law, is there, to compel an unvaccinated person to remain in his house?" (A). "No; but that comes within the police jurisdiction of the State." (Q). "You mean that it was absolutely compulsory that they should stay in the house unless they were vaccinated?" (A). "Yes; that position has been maintained by the courts. If the local health authorities think it is necessary that persons should remain in their houses so as not to endanger the lives of others, they compel them to remain." (Q). "And that applied to all the persons in a house where a case of small-pox had occurred?" (A). "Yes. The result is simply this, that a person would rather be vaccinated than be compelled to remain in the house." (Q). "Practically speaking, it operates as a compulsion sufficient to lead to the people being vaccinated?" (A). "Yes."

Such are the proceedings of the Great Democracy. In Germany, where methods much more autocratic than ours are acknowledged to exist, there is an enormous saving of life and health by means of the stringent law of vaccination and re-vaccination, which is in operation there. It is impossible, and would be unprofitable if it were not impossible, to enter here on the never ending question of where personal liberty ends, and where the rights of Society begin, or the similar question as to the relative responsibility of the parent and of the State for the protection of the infantile community against disease. In this country a vaccination law such as that of Germany seems in the present state of public opinion impossible. The public have to be educated, and they must pay for their education. In so far as they will accept no other schoolmaster than small-pox, their education will be all the more costly, but the lesson, once learned, will be all the more thorough. The pity of it is that this schoolmaster accompanies his teaching by punishment, and that the punishment so largely falls on helpless children. But it has always been the case, in matters physical, intellectual and moral, that the sins of the fathers are visited on the children.

It is our duty to make the visitation as light as possible, and mention of that duty brings me to the consideration of the relation of the medical profession to the prevention of small-pox, in presence of the new law of vaccination. Shall we continue to do our utmost for the protection of the population against

itself, or shall we stand aside and sulk because so-called compulsion has been temporarily abolished? Surely the question contains its own answer. It is mere truism to say that as medical practitioners we are bound to do our best for every patient, no matter how refractory and ungrateful he may be; that as health officers we are bound to do our best for the protection of the districts which have been committed to our charge, no matter what may be the attitude of the people or of the local authority; and that as a profession we are bound to persevere in our efforts to shield the nation from pestilence. The principles which underlie the oath of Hippocrates leave us no choice. If our patient be a man condemned to the scaffold, we must try to cure him of the disease which threatens to rob justice of its victim; though we have reason to believe that the death of an individual would be a public boon, we must endeavour to preserve his unworthy and mischievous life; and surely it is no less our duty to try to protect innocent children from the results of parental error and folly. The State and not the Profession is responsible for the law, but we must continue to advise the State aright, and whatever be the law, even if there be no law, we must advise the individual aright.

Coming to closer quarters with this aspect of the subject let me refer briefly to certain specific points.

(1) In the past a very large number of people though not doubting the efficacy of re-vaccination have yet contented themselves with a single operation. It is obvious that the risk of trusting to this—without renewal of the premium, as Dr. Bond would say—is all the greater according as the possibilities of infection increase. Now, more than ever, is it therefore the duty of medical men to advise re-vaccination as a supplement to primary vaccination. It should be pointed out to the individual that, independently of any law, he can practically defy small-pox so far as he is personally concerned, and that under the new conditions there is all the greater need for his maintaining at its highest standard the protection which vaccination is capable of affording. To the guardians of adolescents, this fact should be strongly brought home.

(2) From this time forward, every vaccination should be done as efficiently as possible. No medical man should ever again yield to a parental request to make only one small mark on a child's arm. Let the standard number of typical Jennerian vesicles be produced, or let the parent go to the petty sessions and there obtain the relief which the new law allows. There can be no hardship in offering this choice, and an incidental result of such a course will be to draw more and

more clearly the already very clear contrast between the vaccinated and the unvaccinated in epidemics of small-pox.

(3) I come last of all to the consideration of isolation as a means of the prevention of small-pox. A century ago, Haygarth held that the atmospheric carrying power of variola did not exceed 18 inches, and that isolation could quite well be accomplished and maintained within an ordinary dwelling house. For us isolation means the provision of hospitals, themselves properly isolated. In regard to this matter of hospitals it seems to me that we are in a curiously anomalous position. If vaccination and re-vaccination were universal, we could practically do without small-pox hospitals, and it is a singular fact that one of the effects of national neglect of vaccination is that we have particularly to discuss hospital isolation regarding that particular zymotic disease for which hospitals would be essentially unnecessary, if only we would take full advantage of that preventive measure which is open to us in the case of small-pox as it is in no other malady.

But we must consider the question on practical lines, and accept the fact that sanitary authorities cannot in the present condition of this country rely on vaccination and re-vaccination being so universal as to render small-pox hospitals unnecessary. That is a fact which the ratepayer must also accept. At the other extreme, from a condition of universal vaccination and re-vaccination there would be an entire absence of vaccination and re-vaccination. What part would hospitals play then? I am afraid that, at least as regards epidemic small-pox as distinguished from sporadic small-pox, they would be practically useless. Knowing what we do of the infective power of the epidemic disease, it seems only too certain that any possible hospital accommodation would be utterly inadequate and that the infection would overleap all artificial bounds. Whether, at the close of an epidemic, we would be in the position of the town of Chester in the last century, is a question which at present is, fortunately, of only academic interest. But in that town, which, according to Haygarth, was a place of "almost incredible" healthiness, only some 7 per cent. of the population had never had small-pox. In the little village of Ware, under similar circumstances, Mr. Anthony Fage divided the population into three classes at the end of an epidemic in the year 1,722. The total population was 2,515. These he classifies thus: (*a*) those who "Had the small-pox before," of whom there were 1,601; (*b*) those who "Had the small-pox this time," who numbered 612; while (*c*) the remaining 302 he describes under the suggestive heading "To have the small-pox." For myself, I would be inclined to hope that in spite of the high convectivity and

infectivity of small-pox, and in spite of the doubts which have been cast on the value of hospital isolation in preventing the prevalence of so mild a disease as scarlet fever, which has no preventive means analogous to vaccination, yet the differences in the conditions of life between this century and the last, would, even in the absence of vaccination, perhaps tend to prevent such experiences as those of Chester and Ware. But we cannot tell and we must fervently hope that we shall never have the opportunity of learning.

My point here is, that if vaccination and re-vaccination were universal, small-pox hospitals would be almost or altogether needless, and if vaccination and re-vaccination were entirely wanting, such hospitals would be almost useless, at least against the epidemic disease. The nearer we approach to this last state, the larger are our hospitals likely to grow, and the more hopeless will it be to rely on them.

In the intermediate condition—the condition in which we live—with vaccination and re-vaccination partially prevalent, hospital isolation is a measure of very great value, and must be a routine part of the procedure with regard alike to the sporadic and the epidemic disease. Experience indicates that the administrative part of a small-pox hospital should be large and well-equipped, and that around it there should be space for rapid extension of whatever ward accomodation is permanently provided. Needless to say, the word isolation means more than the removal of the patient. It means isolation of the poison by disinfection, or still better by destruction, of infected articles; it means not merely the removal of the patient, but his very early removal, and this involves search for persons who have been exposed to infection, and constant watching of such persons during the possible incubation of the disease. All this belongs to the A. B. C. of preventive medicine and must be rigidly attended to.

Yet it has to be admitted that though very valuable, isolation with its concomitants is essentially a precarious protection. Even if we had a law making isolation more strongly compulsory than vaccination has ever been in this country, and even if there were to be no extension of that destruction of small-pox hospitals by infuriated mobs, of which there were two instances not very long ago in the West of England, yet isolation might fail at any moment. Under such a prophylaxis the individual has to depend not on himself but on other people. As I have said elsewhere, his *cordon* of protection is a chain, the measure of whose strength is its weakest link, and over not one link has he any sufficient control. Failure of parents to observe the symptoms of illness; failure to call in a doctor; failure of the

doctor to diagnose small-pox; failure in promptitude of removal; inadequacy of hospital accommodation; insufficiency of disinfection of persons and things;—these are among the risks to which even a law of compulsory isolation would leave a man exposed. On the other hand, by means of vaccination and re-vaccination the individual himself is protected. He carries his protection with him wherever he goes, and the father has control over the protection of himself and his children. All this, however, furnishes no excuse for refraining from utilising to the very utmost every measure supplementary and complementary to vaccination, no matter how uncertain such measures may be.

Finally, we must endeavour by every means in our power, to educate the public who choose our law makers, in the very truth about vaccination. It is nearly twelve years since I first pleaded with the profession to undertake this education. The Jenner Society has within the last two or three years done yeoman service here, and, more recently, the British Medical Association has heartily aided in the work. May I suggest in conclusion that the Sanitary Institute might also now lend a hand?

CONFERENCE OF MUNICIPAL AND COUNTY ENGINEERS.

ADDRESS

By Thomas de Courcy Meade, M.Inst.C.E., M.Inst.Mech.E., F.G.S.,

PRESIDENT OF THE CONFERENCE.

(Fellow.)

With feelings of much pleasure I accepted the invitation of the Council of The Sanitary Institute to occupy the chair at this Conference, which enables me again to take some part in the excellent work The Institute is annually performing. This is the fifth occasion on which Municipal and County Engineers have assembled at Congresses of The Sanitary Institute. The former meetings took place at Portsmouth in 1892, at Liverpool in 1894, at Newcastle-upon-Tyne in 1896, and at Leeds last year. Upon all these occasions the Incorporated Association of Municipal and County Engineers was well represented by individual members—although not collectively—showing that Municipal Engineers are ever ready to embrace all opportunities afforded to them of meeting for the discussion of matters appertaining to their profession, for exchange of ideas, and for mutual advancement.

The interest taken in these meetings proves also that the Council of The Sanitary Institute were well advised in making this new departure in the programme, which has been, I believe, fully justified by the results. At the first of these meetings the chairman, Mr. Percy Boulnois, M.Inst.C.E., submitted his excellent diagram indicating the duties of the municipal engineer under six heads, which embrace no less than 98 distinct subjects. Is it, therefore, surprising that the municipal engineer should always be a student, anxious to learn all that is

new, and desirous to benefit by the experience of other engineers, and by the discussion of papers and criticisms of the views expressed by the authors? It should not, however, be forgotten that the communities whose representatives we have the honour to serve, reap the benefits of the knowledge thus gained, and when this fact becomes better known and generally recognised, the attendance of officials at meetings of this character will, doubtless, be still more numerous. For the information of visitors who may be present, I would add that the Incorporated Association of Municipal and County Engineers was founded upwards of a quarter of a century ago, and numbers amongst its members the Surveyors and Engineers of all the principal towns in Great Britain and Ireland, and that meetings of that Association are held annually in one or more large centres of population, when papers are read and discussed, and works in progress are viewed.

It is not the custom to discuss the points raised in the chairman's opening address. I shall therefore refer in very general terms to a few matters that are likely to be of interest to which I am at present giving special consideration; commencing with that well-worn topic the Housing of the Working Classes. The difficulties of providing sufficient suitable accommodation at reasonable cost for persons of the working class displaced from insanitary areas, or from areas cleared for street improvements and railway works, are in most instances very great, and are generally enhanced by the tendency to overcrowd, which, in many cases, unduly increases the number of persons to be provided for upon areas already too limited. These difficulties have been met in Manchester by the erection, on the cleared sites, of (*a*) blocks of five-storied tenements approached by a common stairs and balconies, (*b*) blocks of tenements of two and three stories, with separate entrance and stairs to each set of tenements, (*c*) terrace cottages of five rooms each, (*d*) a model lodging house. By the kindness of the chairman of the sanitary committee of the Manchester Corporation, Alderman Walton Smith, J.P., drawings of all these buildings have been lent for the inspection of visitors to the Congress. The Manchester Corporation are also erecting (*e*) cottage dwellings in the outskirts of the city, about two and a half miles from the cleared areas, where land is less costly; these cottages vary somewhat in character and contain from five to seven rooms each. The buildings class (*a*) have been occupied about three years, and are let at rents which yield a moderate return upon the cost of erection. The two blocks (*a*) of five-storied buildings cost about £87,000 exclusive of the cost of sites. The latter with old buildings thereon cost about £54,000. Single room

tenements are let at 2s. 6d. per week, the rent of two or three-roomed tenements varies from 3s. to 5s. per week.

In addition to the above-mentioned new buildings, much has been done in the improvement of existing dwellings, and the conversion of "back-to-back" houses into "through" houses. This work, though excellent where it is effected, has a tendency to cause overcrowding elsewhere, as the number of persons that can be accomomdated in the converted and improved dwellings is much less than was crowded into the "back-to-back" houses before alteration. Full details of the procedure of the Manchester Corporation regarding the treatment of insanitary "back-to-back" houses will be found in Dr. Niven's interesting paper on the subject (see The Journal of The Sanitary Institute, Vol. XVI., p. 254). That paper is accompanied by plans showing the methods generally adopted in the alteration of "back-to-back" houses, from these it will be seen that in all cases the groups of pail closets used by the occupiers of one or more blocks of houses are removed, and that each "through" house is provided with a proper water closet. The substitution of private water closets for common pail closets and privies is thus gradually proceeding, but will, doubtless, be a work of time.

There are at present in the city of Manchester 76,913 pail closets, 22,990 privies, and 13,014 middens, but these numbers are annually becoming less, as water closets are being provided wherever alterations to property are effected by the Corporation. About 900 tons of fœcal matter is collected from the pail closets per week, and about half this quantity is dried and converted into concentrated manure and sold; the remainder is mixed with ashes and rubbish, and disposed of amongst farmers on the Corporation estates at Carrington and Chat Moss. These estates have an area of about 3,750 acres, and it is estimated that about 93,000 tons of mixed night-soil can be thus annually disposed of.

The treatment of sewage is a subject of general interest to most of those present, therefore a few particulars of the cost, etc., of treatment at the Manchester outfall works may not be out of place.

The population contributing to the sewage system increased from 400,360 on the 1st of January 1897, to 512,500 on the 31st December, 1897. The average daily flow during 1897 was 20,426,363 gallons. The flow per head of the population ranged from 39·3 gallons per day in May to 50 gallons per head in December last. The quantity of water supplied by the Corporation is about 28 gallons per head per day. It is estimated that about 17 gallons are supplied for domestic use, and the remaining 11 gallons for trading and public purposes. The

difference between the total quantity of water supplied and the average quantity of sewage reaching the works is largely due to the admission of underground water, which passes into the old sewers and drains through defective joints. The nett cost of treatment for 1897 was £19,089 9s. 7d. exclusive of interest and repayment of capital, or £2 11s. 9d. per million gallons treated, apportioned as follows :—

	1896. Per Million Gallons. £ s. d.	1897. Per Million Gallons. £ s. d.
Precipitation (labour and chemicals only)	1 2 11	1 0 7·1
Sludge Disposal (labour and materials only)	0 14 3·6	0 13 9·7
Filtration (a small proportion only of the sewage was filtered) ...	0 1 1	0 0 5·9
Coal (this includes all steam power used on the works, but does not include coal for the steamer) ...	0 3 11·5	0 2 10·1
Sundries	0 0 6·5	0 0 7·7
Incidental Expenses (less Credits and Receipts)	0 11 5·3	0 13 4·6
Total	£2 14 2·9	£2 11 9·1

The above summary of the cost of treating the sewage for the year 1897, shows a reduction of 2s. 5·8d. per million gallons on the cost of treatment for the year 1896.

The proportion of chemicals used during the year 1897 was lime, 5·32 grains per gallon; sulphate of iron, 5·29 grains per gallon—total, 10·61.

The quantities of lime and copperas used are adjusted by frequently testing the sewage after admixture with chemicals. The effluent is kept as far as possible faintly alkaline. For this purpose the addition of a slight excess of lime is necessary, owing to subsidence and precipitation of carbonate of lime in the tanks. The amount of copperas added varies with the sewage, and is estimated by the character of the precipitation observed.

The composition of the sewage varies within wide limits. The sewage begins to attain its maximum strength about noon on each day, and continues strong until midnight or a little after.

The composition of the effluent does not vary so abruptly as that of the sewage, owing to the mixture of the sewage in the precipitation tanks. The effluent begins to attain its maximum strength about 2 o'clock in the afternoon.

The average amount of wet sludge precipitated in 1897 was equal to 21·16 tons per million gallons, as against 21·84 tons for the previous year, yielding 7 tons 12 cwts. of pressed cake per million gallons, as compared with 7 tons 18·4 cwts. for the year 1896.

One ton of wet sludge equals 33·7 cubic feet, and one ton of pressed cake equals 32·12 cubic feet. The average proportion of wet to pressed sludge was at the rate of 2·73 to 1.

The amount of lime used in pressing has averaged 1·40 per cent. by weight of wet sludge, and 3·83 per cent. by weight of pressed cake.

The amount of sludge cake removed by farmers during 1897 was 14,233 tons, equal to an average of about 39 tons per day. The balance of 41,875 tons was deposited in a tip adjoining the works.

The cost of pressing sludge during the year 1897 was 7·7d. per ton of wet sludge for labor, lime, cloths, and sundries, but exclusive of cost of tip, repairs to presses, rolling stock, and insurance. The cost of conveying the sludge to the sea for the first three months of this year amounts to 6·2d. per ton of wet sludge, and includes wages, insurance of steamer, coal, repairs, and incidental expenses, and ship canal charges.

Experiments have been continued since 1895 with coke and cinder filters. The capacities of these filters and of a coal filter as measured on several occasions are :—

Date of Measurement.	Capacity in Gallons.			Time of resting before Measurement.
	Coke.	Cinder.	Coal.	
At commencement of use, in 1895	1,750	1,750		
1897.				
April 26th	1,296	1,260	756	1 hour.
April 28th	1,332	1,404	828	8 hours.
May 27th	1,380	1,477	......	17 hours.
July 2nd..................	1,446	1,548	......	15 hours.
July 2nd	1,425	1,476	......	2 hours.
July 2nd	1,404	1,476	......	2 hours.
October 6th	......	......	*1,260	
1898.				*The filters had been re-filled with washed and screened material.
January 5th	1,260	1,350	......	2 hours.
January 6th	1,278	1,368	......	2 hours.
January 7th	......	......	1,026	
January 24th............	1,368	......	......	After a fortnight's rest.

The results of these measurements show that a considerable amount of moisture is retained in the filtering medium, and that this is slowly drained off or evaporated when the filter is allowed sufficient rest before refilling.

The cinder filter has throughout given better results than the coke, both as regards the percentage reduction of impurity effected, and in non-putrescibility.

CONFERENCE OF SANITARY INSPECTORS.

ADDRESS

By W. W. West, Chief Sanitary Inspector, Walthamstow,

PRESIDENT OF THE CONFERENCE.

(Associate.)

In welcoming the Sanitary Inspectors of Great Britain to this Conference, on behalf of The Sanitary Institute, I am sensible that I am not selected for this honour on account of my own personal merit, but probably by reason of marks of confidence bestowed upon me by my official colleagues in the past, and I am conscious of my own inability to do justice to the occasion. This year I regard as a year of jubilee. Last year the nation was filled with the halo and sentiment of a royal jubilee, which inspired the poet, the painter, and the rhetorician to exhaust their powers of imagination in ascriptions of praise and loyalty to the head of the State. The jubilee this year for us is prosaic, solid, matter-of-fact—*omnia sanitas*. It is true Charles Kingsley has suggested that a poet will arise to write an epic upon sanitary reform, but a high standard of literary and poetic brilliancy and imagery is not indicated by the suggested first line,

"Smells and the man I sing."

The year 1848, with its Public Health Act, stands out as a landmark in our English history, and we may be pardoned for celebrating its jubilee to-day. It is customary in all associations of life to note such occasions, and we may I think justly consider briefly the Inspector's share in the past and future of sanitation.

It is unnecessary to recapitulate the conditions existing fifty years ago; they are too well known to all of you already. But in considering the work that has been done since, I should like to refer to one or two facts mentioned by Chadwick in his reports on the condition of the labouring classes.

Mr. Thomas Porter, Surgeon to St. Botolph's, Bishopsgate District, being asked if the poor people in his district had w.c.'s

provided, said "No, only common necessaries, which are usually allowed to run over before they are emptied; and it is impossible to enter the tenements without being assailed by the disagreeable and unhealthy effluvia thence arising."

"Within the City itself have you perceived the same effluvium on passing the gratings of sewers?"

"Frequently; it is so general that no particular place is distinguished as being free from it."

He also expressed the following opinion: "The carelessness of the people themselves is also deplorable, as it operates very injuriously to their health and comfort. The floors of their rooms, the passages, stairs, and landings are often suffered to remain unwashed for weeks and months, and the walls and ceilings are seldom cleaned or whitened; so that with filthiness of one kind and another they present an appearance of wretchedness beyond all description."

Now these are expressions of facts existing fifty years ago, but do we not all know that they describe accurately things now existing? Could we not, any one of us, go and put our finger almost any day on such a condition? Are there not large towns, and cities, some of which have spent scores and even hundreds of thousands of pounds of money in beautifying their towns and erecting magnificent palaces for the City fathers to deliberate in, which have still, after the knowledge and agitation of fifty years, existing in their midst such abominations as alluded to in the first answer given above?

In the year 1846 the nauseous effluvia emitted from the sewers was of sufficient urgency to engage the attention of the Royal Institute of British Architects, and at one of their meetings in that year Mr. Toynbee opened a discussion thereon, and suggested the use of gas-burners in tall shafts for the purpose of getting rid of the trouble. Still we have the trouble with us, forming one of the most constant sources of anxiety to those engaged in managing our sewers, and the settlement of which we do not appear to be within sight of.

There is no denying that in these and similar directions we have not made the advance that was expected when the first sanitary Acts were passed. Why is this? It appears to me that there are two reasons which in a self-governing country like ours have paramount influence. They are these:—

Firstly: The people immediately concerned have not been sufficiently impressed with the seriousness of the need for advancement.

Secondly: They have not had the power under the law to see that their wishes in the matter were complied with.

It has been acknowledged from the first that those who

suffered most from insanitation were the poorest of our people, inasmuch as besides their exposure to the evils which were the result of neglect on the part of owners of property or local authorities, they were the victims of their own carelessness and ignorance, as indicated by Mr. Parsons in his evidence given above.

As knowledge on the question has spread, so has the demand for power to deal with it increased; as the people have learnt the possibility of remedy so has the cry for improvement strengthened. There may still be a few who regard all disease as inevitable; it is not many years since I was remonstrated with for presuming to interfere in the work of Providence by requiring an owner of property to remedy defects in order to prevent the spread of disease, but the laws of health are more "understanded of the people," and in that is our great hope of their ultimate triumph.

When the Health of Towns Association were making an exhaustive inquiry into the subject, their Liverpool friends replied that "the secret history of the working of our Act has proved that no law for the health of the people can be safely intrusted to a merely irresponsible Local Board."

There was much truth in that statement then, and we inspectors have some of us had painful personal experience of its truth down to recent times. But why was it? The Boards were composed of those who had interest in not being compelled to spend money, and their constituents, those who voted them upon those bodies, had interests in the same direction. Our Liverpool friends correctly described the position at that time, but they did not foresee what we have lived to see, the time when the conditions are inverted. When the people most immediately concerned help to compose the authorities, and have sufficient electoral power to compel from all parties a recognition of their needs, and the admission that the expenditure of money, even in large sums, upon the securing of perfect sanitary requirements is not simply an expenditure out of the pockets of one class for the benefit of another, but a common charge for the common good.

If the people concerned are increasingly becoming aware of the urgency of these questions to them, as undoubtedly they are, inspectors can claim a very large share in the work of spreading among them that knowledge. We must of necessity be in advance of general opinion. Apart from our individual enthusiasms, the very necessities of our position and work push us along, and make us, have made us missionaries of sanitation. We have not always been chosen for our courtesy, sweet reasonableness, possession of the *suaviter in modo* temperament,

we are much the same as the mass of our fellows in those respects; we have not invariably been selected for our superior special acquaintance with the laws of health, but as a body we have been just that distance in front of general opinion which our work necessitates, and which the sense of the community demands and will allow. Here and there, however, there have been opportunities, or needs for an emergence from the mass, and there have generally been the men there for the purpose.

"The necessity of a complete and accurate system of registering disease both fatal and otherwise, will at some future time be admitted by advocates of sanitary progress to be the alphabet of sanitary science. Without a correct knowledge of the history and specific intensity of diseases, it is impossible to expect complete success to attend our efforts to prevent the spread of even filth diseases. To be acquainted with the diseases of the district in their entirety; to be able to point out the special localities of special diseases; to be able to give the specific intensity of diseases connected with sex, age, occupation, modes of life, and the external influences by which people are affected, is to enable the sanitary student to determine without doubt the true predisposing causes of disease. That the sanitary operations of the future will be placed upon this basis I have not the smallest doubt. I believe the day will come when the contents of the vital statistical record of the town will be deemed to be the best historic reference relating to the inner life, health, and therefore the wealth of the people of Leek." This is an extract from a report in the year 1856, by our honoured colleague Mr. R. Farrow, of Leek, and shows an absolute grasp of the fundamental principles of sanitary science, the application of which under his direction prepares us for the statement that after thirty years' work his town shows a decrease in the sickness and mortality rates of 30 per cent., and a corresponding increase in the average length of life of 30 per cent. No wonder that our aged friend says, and we join with him: "Some glory in the number of lives and the amount of property they have destroyed; we glory in having been instrumental in the saving of life and diminishing of human suffering."

Twenty-five years ago the attention of Mr. H. Alexander was directed to the foul conditions under which the supply and storage of water in the houses in the parish of Shoreditch were carried out. He describes how the supply was turned on twenty or thirty minutes three times a week, and a bag was tied over the ball-cock to prevent small fish, and the larger impurities, from entering the cistern; the cisterns were over or in W.C.'s, in or under bed-rooms; often with filth, dead animals, or masses

of fungus in them. Grasping at once the crux of the position, he persistently brought it under the notice of the authorities, and at last earned the gratitude of the inhabitants by obtaining that constant supply which is recognised as a *sine quâ non* of perfectly healthy conditions.

Another and more recent instance of the inspector (in the person of Mr. Alexander) being in advance of the general opinion may be seen in his lengthy controversy with the London School Board on the question of substituting separate W.C.'s for trough closets in their schools. In a few years to come it will be barely conceivable that any responsible body could persist in exposing the children under their control to the conditions inseparable from the use of the trough closet—conditions to which they would not expose their own families—and which are only submitted to at all because they are not quite so bad as, are some improvement on, the old privy or pan. The reports which the teachers have supplied to the Board on the experience of the use of the W.C. system have been thoroughly satisfactory, and have resulted in an extension of their use—a fact upon which all those who look upon our schools as to be from all points of view educational in the fullest and best sense, will unhesitatingly congratulate our friend.

It is an inherent necessity with all reformers to have a Utopia to ponder on and to desire. Some are content with Bacon to dream of it and write about it; some, like Feargus O'Connor and Owen, to try and get it into being; we combine the two.

Our great apostle, Sir B. W. Richardson, drew the picture of it, and following in the industrious and never-faltering footsteps of our revered leader, we will work for the ultimate completion of the City of Hygeia. While trying to foresee its plan and method of construction, he with the insight of a true reformer recognised that it must be founded on the free will of the inhabitants—

"Broad based upon the people's will."

It is to be "a *community* so circumstanced and so maintained by the exercise of its own free will, guided by scientific knowledge, that in it the perfection of sanitary results will be approached if not actually realised, in the co-existence of the lowest possible general mortality with the highest possible individual longevity."

The details which he sketched have nowhere been realised in more than one or two items, and those only in the houses of the well-to-do, while with reference to a few others we are tending

in their direction. To uproot the habits and inherited tendencies of nations is a work for Hercules or for time. We can only proceed a step at a time. With all our shortcomings and defects, we have undoubtedly taken many steps. Similar incontrovertible facts to those given by Mr. Farrow, of Leek, can be related as to many of our towns and cities. We are rapidly approaching this lowest possible general mortality, and persistent work on the lines already laid down in our health laws must bring about the desired end.

Our work is not yet finished. In the early days the Health of Towns' Association, when urging the need for sanitary reform, were met with the objection that a large and expensive force of officials would be required to enforce and superintend. To overcome this objection they suggested that "whensoever the proposed local consolidations were effected, and complete works laid down and put in action, public servants by whom the work and consequent pecuniary savings and savings of life and health have been effected, will have comparatively little to do and may change their sphere of action." Well, the end is not yet. Where is the district in which the staff is so sufficient that it is able fully and completely to deal with the work required by the various Acts of Parliament?

Public Health Acts, Housing of the Working Classes Acts, Adulteration Acts, Infectious Disease Acts, Factory and Workshop Acts, passed year after year, piling Pelion upon Ossa, make the work of sanitary inspection grow to mountainous proportions, and the need for more inspectors grow at a pace far greater than the willingness of the authorities to increase their numbers. This with the greater demand by the people in requiring attention to details where formerly only gross defects were troubled about by them, due to the greater refinement resulting from truer opinion, will put off indefinitely the day above referred to, when we may rest on our laurels. We have need then to cry to the people "Come over and help us." Do your part in those matters in which the individual can act, we will attend to those things the Community must do.

We have then in the future to follow up the work of the past. We have to keep well in advance of the general opinion of our districts. Not to wait to be told what to do, but to point out to others what needs to be done, to lead the way, to explain, to reason, to be missionaries of health. It is said authoritatively that what is required most at the present time is not legislation but education, and there is undoubtedly much truth in that saying. Could we have each individual in the state made to realize his own duty in these matters by personal conviction, doubtless we should be nearly approaching perfection. But we

cannot forget that the law is, at any rate at present, a powerful factor in the education of a vast number of people; to know that a certain thing must be done, helps to prove to them that it should be done, and lead them to enquire the reason why; and until every one is actuated by disinterested desire for the general good, until it is no longer possible for any person to make a profit out of the evil conditions which injure others, legislation, drastic and deterrent will be necessary.

Be it our work then, day by day, in season and out of season, to continue our share in the educating of those most immediately concerned in the understanding of that watchword, "Cleanliness," in the full meaning of which is comprised all our sanitary measures; confident that when we have enabled all to understand the duties which it imposes upon them, we shall have secured that approach to the perfection of sanitary science which our prophet foresaw.

The great demand at present, the great need is air, pure air; much has been done to secure good drainage, pure food, pure water, but most remains to be done to give the people pure air. The overcrowding of the people is the most crying evil, and that which is perhaps the most difficult to deal with. It is exceedingly doubtful if the most zealous efforts of the best equipped sanitary authority in great towns can make the slightest real impression upon the amount of overcrowding existing within its borders. The poor people may be driven from room to room, from street to street, or to an adjoining district, but with a greater number of people compelled to live within a certain area than the houses of that area will legally accommodate, overcrowding is inevitable.

One inevitable outcome of the desire to improve upon these conditions has been the application to them of the moral axiom, "there is always room at the top," by the erection of tenement dwellings of many stories in height. Even where these have been erected under good supervision, it is very doubtful whether we are not hindering the acquirement of the essential condition of life, pure air. It is, however, a first essential in a vast city like London to do our best, first to modify the bad conditions, in default of ability entirely to remove them, and really well designed tenements would undoubtedly help to that end.

It has been suggested by ardent reformers that a system of free transport to the suburbs for those who work in the City would help to remedy the evil; others would impress upon us the iniquity of the existing land laws, which enable the owner of land in cities to take advantage of the necessities of his fellows for his own aggrandisement; others see in the utili-

sation of the water power of our rivers for electric force the decentralisation of our manufacturing operations, and lessening of attraction to our great towns. Without the necessity for our attaching ourselves as a body to any one of these policies, or of the many others which are held before us, we may individually and collectively use our influence to impress upon the body politic our conviction that every step that can be taken, every road opened, to provide for the people of our towns the pure air and sunlight which are an essential condition of healthy life, is a step towards the maintenance of our position amongst the nations of the earth, whether it be as a manufacturing nation, a controller of the seas, or as a leader in the moral, intellectual, and religious life of the world.

CONFERENCE ON DOMESTIC HYGIENE.

ADDRESS

By The Lady Mayoress of Birmingham
(Mrs. C. G. Beale),

PRESIDENT OF THE CONFERENCE.

In the name of the women of Birmingham, I bid you a hearty welcome to this Conference, and I trust that the papers and discussions we shall hear to-day may bear fruit which will ripen and scatter good seed, not only for the benefit of our own community, but over a widespread area. That women should be invited to take part in such a Congress as this is a sign of the progress of the times, and perhaps I may add shows an appreciation of the public work which they are now doing.

The motto of our city is "Forward," and I hope we women shall be true to it in the best sense of the word, always being ready to come forward to assist in any work for the spread of knowledge or the betterment of mankind, but not wishful to thrust ourselves into positions which are better filled by men. What we want is to work side by side with men where women and children are concerned. I strongly advocate the election of women as guardians, factory inspectors, sanitary inspectors, &c.; but in all cases where a woman is called upon to do public work, I would repeat what I have said elsewhere that she should make herself thoroughly acquainted with the business she is about to undertake, remembering that the eye of the public is upon her, that being a woman her doings will undergo a close scrutiny and criticism, and that if she fails from incompetency her failure retards the recognition of women workers.

In reviewing the work done by women in Birmingham in regard to health and domestic hygiene, I may mention that it is now rather more than a quarter of a century since the late Miss Kenrick, following the example of Mrs. Buckton of Leeds, began a series of lectures on the Laws of Health to women and girls over 15. Other lecturers were encouraged to come forward, and under the auspices of the Ladies' Useful Work

Association and its devoted Hon. Sec., the late Miss Martineau, the movement proved to be a most successful and popular one, and large audiences of sometimes as many as 400 women were gathered together weekly to receive instruction, and much useful knowledge was spread (by means of these lectures followed by the distribution of sanitary tracts) among the poorer classes, who up to that time had been in utter ignorance of the simplest laws of health and how to improve the condition of their lives and houses.

The Health Committee of the City Council gave every assistance to the movement, and has borne testimony to the value of the work done. The lectures are still continued, and probably the need is as great as ever for them; but our Hon. Sec. tells me that the audiences are diminishing, and the cry is for something new. Fortunately other sources of knowledge are now open to the working classes principally through the Athletic Institute, which arranges for series of lectures by medical men in different parts of the city.

The Health Committee of the City Council has lately been paying great attention to the cleansing of the courts of this city. For the information of strangers among us I may say that Birmingham differs from Liverpool and London in having no underground dwellings, no cellars; but these courts, of which there are about 6,000, are many of them very old and insanitary, the houses being built back-to-back with no proper ventilation, and the courts themselves being badly paved and most insufficiently provided with decent accommodation. The Health Committee issued notices to 1,500 of the occupiers of the worst of these courts calling upon them either to cleanse the courts themselves or else they would be cleansed by the Health Committee at the occupiers' expense, and they have been much gratified to find that in only 515 cases were they obliged to do the work, and that in all the other cases the occupiers did it themselves.

Since the Health Committee has taken action there is a marked improvement in the cleanliness and general well-keeping of the courts, but much remains to be done in impressing upon the inhabitants the danger they run in neglecting the laws of health. Gross neglect is shown in not taking proper precautions against the spread of infectious diseases. It is frequently found where scarlet fever, diphtheria, or typhoid fever occurs, that the neighbours are allowed to enter the house and even to see the patient before and after death. Measles and whooping cough are regarded as inevitable, and no steps are taken to avoid them. There is a growing tendency to surround the houses with ducks and fowls kept in badly constructed pens

which speedily create a nuisance. Then house refuse is consigned to the tub-shed instead of being burnt or being carefully put into the tubs provided, and slop-water is thrown into the dry ash receptacle. All these things do not contribute to the wholesomeness and freshness of the court. Many other instances of neglect might be cited, but I have said enough to call your attention to the fact there is great need of more knowledge of domestic hygiene in our city.

The way is being paved for a larger extension of women's work in Birmingham, and it is hoped that in the Spring the Women's Settlement may be established, which will probably promote the mingling of classes which would otherwise be difficult to accomplish.

The influence of an educated woman—and by educated I mean one who has a real practical knowledge of the needs of the poor, and the machinery which can be set in motion to remove or mitigate the evils by which they are surrounded—such a woman I say can do more to spread the knowledge of domestic hygiene by personal example and encouragement than can be done by wholesale teaching.

The intelligent women of the working classes must be made to realize the perils of the insanitary conditions under which they live, and the absolute necessity for the improvement of the same. This cannot be attained only by the erection of better dwellings, for until they know how to maintain these dwellings in a clean and wholesome state, their own health and that of their families will continue to suffer.

This autumn the experiment has been tried of having evening concerts in the courts, and I believe the general cleaning up and decoration and embellishment on these occasions has been most noteworthy. Surely a small effort like this must tend to teach the people how much cleanliness can be appreciated.

During this Conference we shall hear a paper on District Nursing, a subject which lies very close to my heart, as I regard it as not only a means of relieving suffering and misery without pauperism, but as a great means of education for the people. The daily presence of a nurse in a house for some weeks must surely leave some trace of knowledge behind which may be recalled in a moment of emergency, and may tend to remove some of the prejudices against cleanliness and ventilation which cause so much illness now. I think the women will be found willing enough to learn if only their interest can be roused by simple practical teaching; for instance, if they could understand that there is a difference in drugs and not class everything under the one heading of "medicine" or "doctors'

stuff" something would be gained, and we should not hear of medicine prescribed for an adult at the Women's Hospital being given to a neighbour's child who was ill, because it being "medicine" it must be good for it; or as in a case which came under my own notice where a mother, pointing to her small boy, said: "Yes, the doctor says he has twelve separate complaints on him now, but I let him play in the gutter because they say as how the dirt draws out the whooping cough."

If some classes for girls on simple nursing and first-aid could be added to the programme of the many girls' clubs now established in Birmingham they would probably prove attractive, and much useful knowledge might be instilled. I have heard of girls who have attended such classes being of the greatest assistance to their families in cases of illness.

LECTURE TO THE CONGRESS,

By CHRISTOPHER CHILDS, M.A., M.D.Oxon., D.P.H.,
Lecturer on Bacteriology in relation to Hygiene,
University College, London.
(Member.)

THE PREVENTION OF POLLUTION OF OUR STREAMS AND RIVERS.

From time immemorial it appears to have been the custom with the people of this and also of other countries, whenever running water in the form of brook, or stream, or river was conveniently at hand, to commit all the excreta of the individual, the refuse of the household, and the waste products of industries to that water.

When no running water was near the same foul products were cast upon the soil or into pits, there to putrefy and give forth poisonous gases to the air, to form a breeding ground for those microscopic germs which we now know to be the causes of so much disease and death, and to poison the subsoil water; that same water which was used for cleansing purposes, and for the food of those very people who caused its pollution.

It would be idle for me to recapitulate before this audience the tragic history of sickness, misery, death, and financial loss which have unceasingly been recorded, even up to this very day, owing to this innate carelessness with regard to the safe and fitting disposal of human excreta and domestic refuse.

And yet, in spite of these direful warnings, in spite of the teaching and unwearying efforts of the Apostles of Preventive Medicine, in spite of all modern sanitary reforms, the accumulated legislature of the last sixty years, and our advanced knowledge with regard to the laws of health, this national custom still prevails, and no words are necessary to prove that pollution is common throughout the length and breadth of the land.

The question which constantly calls for our serious attention is—How this custom is to be altered? How the people of this country are to be induced to keep soil water and air uncontaminated by human excreta and the refuse of households and factories.

In a paper, introducing a discussion on Waterborne Typhoid

Fever, which I was invited to read before this Institute last March, I ventured to suggest that a Conference on River Pollution might be made a constant item in the Annual Congress. The Council decided to appoint a Standing Committee on River Pollution, and requested me to give an address on this subject at the present Congress—an honour for which I take this opportunity of tendering my grateful thanks.

I was somewhat dismayed to find later on that the discussion of River Pollution was to form part of the programme at the meeting of the British Medical Association in Edinburgh, and also at the Congress of the Royal Institute of Public Health at Dublin, fearing that it would be necessary to throw much of what I had written into the waste paper basket. It was consoling, however, to realise that this important question is being taken up throughout the United Kingdom, and that I should be able to enlarge upon certain points which I think require our special attention.

The discussion at Dublin I unfortunately missed, nor have I succeeded in finding an account of it.

The admirable paper read by Dr. Maclean Wilson at Edinburgh, together with the practical and instructive discussion which followed it, is reported in the "British Medical Journal," of Aug. 13th. It should be studied by everyone interested in the subject.

We have also to thank Professor Glaister for his excellent and comprehensive address on the "Pollution of Scottish Rivers," which he delivered to the Philosophical Society of Glasgow in January, 1897.

Professor Glaister made a special inquiry into the nature and amount of pollution existing in the industrial counties of Scotland, with the result that he found "the extent and incidence of river pollution substantially the same to-day as it was 25 years ago, when the Commissioners made their inquiries into the condition of rivers."

Originally, I intended to have made a similar inquiry into the nature and extent of river pollution in England and Wales, but with the short time at my disposal it became obvious that such an undertaking was impossible. The results of such an inquiry would be of the greatest service. Possibly it may come within the scope of the present Royal Commission on Sewage, or it might be carried out without much cost or difficulty by the Local Government Board, with the help of the Medical Officers of Health.

It would probably be found that things are no better on the south side of the Tweed than they were shown to be on the north.

In any case it is generally admitted that the Rivers Pollution Act of 1876 has generally and persistently failed in the purpose for which it was intended, and that pollution has very generally continued and progressed unchecked in defiance of the law, and of the many efforts made to reduce it.

Difficulties in the way of Reform.

The chief difficulties in the way of the much desired reforms are the ignorance and indifference of the people; the great cost of sewage purification and the uncertainty with regard to the best means to be employed; last, but not least, the defects in the law itself, and the impotence of the measures provided for its administration.

One of the first and greatest obstacles in the path of progress is undoubtedly the apathy and indifference with regard to pollution which is suffered to occur and to be persisted in in all parts of the kingdom.

We cannot hope for thorough and effective legislation until the people have been roused from this indifference; until they are made fully conscious of the disgusting contamination to which our water supplies are so commonly liable; are convinced of the consequent danger to which they are so constantly exposed, and insist upon those reforms which will afford them reasonable protection. This indifference is due in a large measure to habit and custom, but chiefly to ignorance; ignorance of different kinds and degrees, and common to all classes; ignorance of the simplest laws of nature, of the most obvious laws of health, of the nature and causes of those diseases which are conveyed through water, and of the ways in which such diseases spread from man to his neighbour or to a large community. Such ignorance can only be dispelled by systematic, persistent, and widespread education in these matters.

Next to the obstruction of ignorance and indifference, the great cost of purification of sewage and trade refuse, together with the constant uncertainty with regard to the best methods of purification, have proved frequent hindrances to the well-intentioned efforts for reform made by the more enlightened members of local communities. At the present time, however, we may congratulate ourselves that there is a definite prospect that these two difficulties will be reduced to a minimum. The researches and practical results obtained by the Massachusetts State Board of Health, by Scott Moncrieff, Dibdin, Dupré, Donald Cameron, and others, plainly demonstrate that the great difficulty, uncertainty, and cost of purification, which have blocked the way for so many years, have been in a large measure

due to our misconception of the true principles by which we should be guided in dealing with domestic sewage. We have constantly endeavoured to thwart and destroy those natural agents for the purification of foul matters, the liquefying and nitrifying bacteria, as if they were our greatest foes, instead of our best and most indispensable allies.

The discovery and practical application of the so-called biological methods of purification form one of the greatest triumphs of modern sanitary science.

These methods have been on trial for sufficient time and on sufficiently large scale, to prove that they have to a great extent solved the clue to this most difficult and complicated problem. If they finally and completely succeed, they will remove the chief practical difficulties which block the way, and will save the country the annual expenditure of many millions.

It will be well at this point to consider in the light of our more recent experience, the exact objects to be aimed at in the process of sewage purification, and the means by which such purification may be obtained and secured.

The chief object of purification of sewage and refuse is to secure that the effluent from any sewage, manufacturing process, or filth accumulation to any "stream" (as defined in Clause 20 of the Rivers Pollution Prevention Act of 1876), shall be purified in such a way that it shall not cause the water of the stream to be poisonous or dangerous to the health of those who drink it; nor be detrimental to the manufactures for which it may be used, nor offensive to the sight or smell, nor destructive to fish, nor obstructive to the flow of the stream. Of these conditions, that which makes the water poisonous or dangerous to the health of those who drink it, is the most important one for our consideration, and the most difficult to define.

How are we to define the term poisonous or dangerous to health?

From the time when serious attention was given to the pollution of our streams by foul matters, culminating in the work of the Rivers Pollution Commission of 1868, great stress has been laid, and rightly laid, upon the amount of effete organic matter contained in the effluents and in the water used for drinking purposes.

The limits of the amount of organic matter to be allowed in any effluent, as gauged with the help of Frankland's method by the amount of organic carbon and organic nitrogen in a given quantity of the fluid effluent, were laid down in the well known suggestions of the Rivers Pollution Commission.

At that time, however, the germ theory of disease was hardly known: bacteria were not recognised as the active agents, the

vera causa of infectious diseases, and consequently the amount of organic matter in an effluent or in water became the recognised chief test of the danger or safety of these fluids.

Now, although the amount of organic matter (and of certain inorganic compounds, such as chlorides) in a natural water is a most delicate test and indication of contamination with animal or vegetable matter, whilst in an effluent it is a measure of the putrescible matter which still remains to be oxidised, it cannot be too much insisted upon that the amount of organic matter in an effluent or in water, as gauged by any of the recognised chemical methods (Frankland's, Wanklyn's, Tidy's, and others) is not a test of the actual poisonous character of those fluids.

It is generally accepted that water polluted by sewage is always dangerous to health, and frequently the actual cause of outbreaks of cholera and typhoid fever. But it does not follow that the quantity or quality of organic matter which is dissolved in the water determines these outbreaks. In fact water strongly contaminated with sewage may be drunk for an indefinite time without causing cholera or typhoid fever.

It is necessary to lay stress upon these statements because there is a tendency to regard a sewage effluent as "purified" when the putrescible matter contained in it is reduced down to a certain standard, whilst the idea, even in these days, seems to be prevalent that the actual poisonous or wholesome character of water for drinking may be decided simply by chemical analysis.

It is only under certain conditions that water so polluted causes these diseases; those conditions being the introduction of the specific poisons of cholera or of typhoid fever under circumstances favourable for their development and convection.

The poisons of cholera and typhoid fever, it has long been known, are contained in the excreta of patients suffering from those diseases, and according to the accepted teachings of bacteriology those poisons consist of living bacteria, the spirillum choleræ Asiaticæ of Koch, and the bacillus typhosus of Eberth and Gaffky.

Water strongly contaminated with sewage, unless it contains the bacterium of cholera or typhoid, cannot cause cholera or typhoid fever, any more than grapes may be gathered from thorns or figs from thistles.

Though the quantity and quality of organic matter in any water are of great importance as an index of the degree, kind and source of pollution, they are not a measure of danger or safety. The real factor which determines the danger or safety of water for drinking purposes is the presence or absence of living germs of disease, the "pathogenic bacteria."

What diseases have definitely been proved to be due to drinking water contaminated with human excreta?

It must be admitted that they are but few.

Most authorities agree that cholera and typhoid fever are the only infectious diseases conveyed by drinking water in this country.

It is probable, however, that diarrhœa and various ill defined low states of health may be conveyed in the same way.

Now, since cholera invades our shores only at intervals, and each recent invasion has been more and more successfully repelled by the sanitary measures so admirably organised against it, the most important and most constant object in sewage purification, having regard to the public health, is the destruction of those micro-organisms which are recognised as the cause of typhoid fever, the bacilli typhosi of Eberth and Gaffky.

The first step, however, for the prevention of infection in our water supplies with the fever poison, is not the purification of sewage but the destruction of the fever germs before they have escaped from the sick room of the patient into the soil, the sewers, or the drinking water. Sufficient attention has not been paid to the fact that when the typhoid bacilli have been allowed to escape alive from the sick room and dwelling of the fever patient into the drain or cess-pit, or other receptacle, it becomes most difficult, if not impossible, to trace or detect them, or to effectively destroy them with germicidal agents.

Until the living bacilli (contained in the excreta) have been thus conveyed to the outer world, they are entirely at the mercy of the nurse, on whom is laid the serious responsibility of protecting herself as well as others from the living poison by killing it at the earliest opportunity.

That this responsibility is not sufficiently realised is shown by the too great frequency with which those engaged in nursing the patients become infected, not only amongst the poor and ignorant classes, but even in some of our great hospitals.

Against the invasion of typhoid fever the nurses hold the first line of defence; and it is no exaggeration to say that the first and most important steps for the prevention of pollution of our water supplies with infectious material, and safeguarding the people from typhoid fever, begin at the bedside of the typhoid fever patient.

I feel compelled to give more than a passing notice to the subject of disinfection in cases of typhoid fever, because I am assured that this disinfection is most imperfectly performed throughout the country.

If complete disinfection were carried out in all cases of typhoid fever, this disease would rapidly disappear, and the

dangers resulting from sewage pollution of our water supplies would be greatly reduced.

What means have we for securing the destruction of the typhoid bacilli and other pathogenic bacteria, when they have once gained entrance into sewage?

There are no direct experimental proofs that the bacilli of typhoid fever are destroyed in sewage by any of the processes of purification at present in use. Nor is there much prospect of obtaining such proof at present, owing to the great and special difficulty of detecting and verifying the presence of these bacilli in such fluids as sewage. This difficulty can only be fully realised by those who have had large experience in such investigations; and is due partly to the absence of any specific active properties peculiar to these bacilli (except in the "serum test"), partly to the strong resemblance between these bacilli and many others which almost invariably accompany them,—notably those known as "the bacilli of the coli group." It is generally admitted that many of our best bacteriologists have been deceived by this resemblance, and that though the presence of bacilli typhosi have frequently been reported in suspected waters it is very doubtful whether the bacilli have actually been isolated and verified even where the water has been obviously contaminated by excreta of typhoid fever patients.

The experiments of Laws and Andrewes, it is true, indicate that "sewage does not form a medium in which much if any growth is possible for the bacilli typhosi under natural conditions; and that their death is only the matter of a few days or at most a week or two."—(Report to London County Council, 1894).

Until the results obtained by these observers have been corroborated by repeated experiments under similar and under varied conditions, it would be inadvisable to form a final conclusion or to base any practical system upon them.

An exhaustive investigation of the quality and quantity of micro-organisms to be found in the sewage effluents obtained by different processes at present in use is much to be desired. But such investigations are very difficult, can only be conducted by skilled bacteriologists of great experience, and will require a long time for their completion. Similar information is needed with regard to the vitality of typhoid bacilli in various kinds of water.

Such experiments are being carried on at the present time in this country (as well as on the Continent). For instance, Professor Boyce contributes a paper to this Congress on "The Flora of Sewage."

Dr. Houston is making bacteriological analyses of the crude London sewage. Professor Delépine is making a "Bacteriological Survey of Surface Water Supplies."

How far may we trust to natural agencies for the destruction of the bacilli typhosi when they have been conveyed by a sewage effluent into a large river such as the Severn or the Thames? Here again we have no direct experimental proof, owing chiefly to those difficulties mentioned above. It has been shown that these bacilli can live for one to three weeks in ordinary drinking water, but it is possible that they may live longer.

From our general knowledge of them, and by analogy, we may infer that the chances are against their living very long in river water. They do not form spores, and are therefore not very resistant to adverse conditions. Sunlight, it has been shown, has a weakening and inhibitory effect upon them, and probably diminishes their virulence.

It is conceivable that before long some practical and economical method may be devised for completely sterilising sewage effluents so that no living organisms—pathogenic or non-pathogenic—may escape in them into the stream.

If we turn to the evidence of medical statistics and epidemiological facts we find abundant instances which show that the typhoid mortality in towns and cities supplied with water from upland surfaces does not seem to be less than that of towns and cities deriving their water supply from rivers, provided that the river water is efficiently filtered. Such appears to be the case generally on the Continent, in America, and in our own country. This evidence, however, is fragmentary and incomplete and requires most careful investigation before any final judgment can be formed from it. I am at present engaged in an enquiry with regard to the typhoid mortality of the chief towns and cities of the world in relation to their water supply, soil, drainage, and other conditions, but it will be long before I shall have sufficient evidence for the formation of a definite conclusion.

If we could obtain evidence extended over many years with regard to the mortality from typhoid fever amongst several millions of people drinking water from a river which has been contaminated by sewage, and compare that mortality with the mortality of several millions supplied with water never so contaminated, other conditions being equal, we should have the conditions of an experiment on a vast scale, from which we might hope to form reliable conclusions.

Such conditions we have in the history of our great metropolis. According to the evidence brought before the Royal Commission on the Metropolitan Water Supply (1893), the

typhoid mortality in London is exceptionally low. When compared with that of fourteen other great English towns, "that have public water supplies which are not excrementally polluted," during the period 1881—1890, it was found to be very little higher than that of four of these large towns, and lower than that of the remaining ten.

Moreover, all the medical, chemical, and bacteriological experts examined by the Commission stated unhesitatingly that they knew of no single instance in which the consumption of London water had caused disease.

These facts and conclusions are of great import, though those who contemplate them have been, and will be, differently impressed by their significance, some being convinced that water supplied under conditions such as obtain in London must be regarded as reasonably safe.

Such for instance was the conclusion of the majority of the Royal Commission for the Prevention of Pollution of Rivers of 1868. Such also was the unanimous conviction of the Royal Commission from whose report I have just quoted.

Others, on the contrary, do not consider that water derived from the Thames and Lee can ever be used for drinking purposes with reasonable safety, even though the sewage effluents which enter those rivers be "purified to the highest extent known to science."

Dr. Bostock Hill, in his excellent paper on "The Safeguarding and Examination of Public Water Supplies," put the case very clearly and concludes his reasoning thus:—"Does not the teaching of hygiene, and the sterner teaching of practical experience point to the fact that methods of purification depending on human effort are sometimes found to fail, and that at critical times the imaginary safeguards cease to exist?"

The case of Altona might be quoted in support of this last argument of Dr. Hill's. It will be remembered that in the great cholera epidemic at Hamburg in the autumn of 1892, the contiguous town of Altona was comparatively free from the disease, although the source of the water supply from the Elbe was far more polluted than that of Hamburg. The escape of Altona was generally attributed to the fact that the water supply was submitted to careful sand filtration, "whilst in Hamburg the Elbe water was distributed in its raw condition as taken from the river."

Nevertheless, in spite of the awful warning immediately before them, a gross flaw in the Altona filters was suffered to pass unnoticed in the following December, and was detected only when too late by a sharp outbreak of disease amongst

those supplied with water from the defective filter. "One of the filters which had been cleaned during the frost had become frozen over, and was in consequence not able to retain the bacteria," a fact which was subsequently proved by bacteriological examination of the water derived from this special filter.

In any case it is imperative that water supplied from any river or other source which has been polluted in the least degree by sewage or organic matter, after adequate storage and sedimentation, should be subjected to complete and carefully managed sand filtration, before it is distributed into the water mains.

In dealing with this vexed question whether a river water which is polluted or liable to be polluted with excrement, can ever be regarded as a reasonably safe source for public water supplies or not, I wish not to abuse the position in which you have done me the honour of placing me by any special pleading for one side or the other, where such large interests are at stake.

But in view of the facts and arguments which I have laid before you, I feel compelled to adopt and uphold the following principles.

(1) That where a community is able to obtain a water supply free from the possibility of any contamination instead of one liable to such contamination, that community is bound for the sake of the safety and the welfare of its citizens to procure the supply which is above suspicion.

(2) That in cases where there is no alternative but to use the water of some adjoining river, or other source liable to pollution, no measures should be neglected whereby poisonous and noxious elements may be prevented from finding entrance into the water, and whereby the last traces of such poisonous elements, if they have found entrance, may with certainty be removed through the best means available.

The city in which we have the privilege of meeting to-day is greatly to be congratulated upon having acquired a magnificent and unrivalled water-shed amongst the mountains of Wales, through which an ample and pure supply is secured for its growing population, the whole gathering ground and every tributary and spring being the property and under the protection of the Corporation. Through the kindness of the engineer, Mr. Mansergh, who is giving an account of this great undertaking to the Congress, I was enabled to visit the works this spring, and can bear witness to the grandeur and completeness of this colossal triumph of engineering skill and human enterprise.

Birmingham was compelled, owing to its high position and

the absence of sufficient water supply at hand to go far afield. But to many towns and cities such irreproachable watersheds are not available, and they must rely upon neighbouring springs, streams or rivers for their supply. Moreover, difficulties of a serious and complicated nature already begin to be felt, owing to the rise and competition for upland water supplies.

All these considerations serve to indicate and emphasize the urgent necessity of preventing and utterly abolishing the pollution of our streams and water-courses.

"The Best Practicable and Available Means."

Bacteriological and epidemiological evidence, it will be seen, give little or no help at present in deciding on the "best practicable and reasonably available means" for destroying the pathogenic bacteria in sewage. Until further evidence is forthcoming we must be content with those means which are best for purifying an effluent to the extent that it will not cause putrefactive or other offensive processes to occur when it has passed into a stream.

As mentioned previously, the difficulty of exactly defining this term, "the best practicable and available means," has proved one of the many obstacles to progress.

The treatment by irrigation on land which has so generally been insisted upon subsequent to filtration and precipitation, or to both, has proved a heavy tax to many communities, and a [illegible] obstacle to the adoption of any process of purification at all.

In many cases, either the high cost of land, or its utter unsuitability for the purpose, or its position have prevented it from being anything like available or practicable.

But there is every reason for hoping that by the new biological methods recently established, a way will be found by which the difficulties may be overcome, and though these methods may not altogether supplant that of irrigation, they will no doubt simplify the process in some cases and diminish the amount of land required, and in others do away with the necessity of land altogether.

Whichever biological system proves the best, it has undoubtedly been shown that by withholding chemicals altogether, and by placing the countless hosts of bacteria which throng every drop of domestic sewage under conditions favourable for their development and activity, the solid materials of sewage may be broken down and liquefied, and subsequently oxidised so as to form a clear and non-putrescible effluent.

How far these methods will succeed in dealing with

manifold and complicated materials which are present in sewage, mixed with trade effluents, remains to be seen.

Almost every noxious and offensive trade effluent that exists is probably represented in Lancashire and the West Riding, and as experiments have been for some time carried on at Leeds, Bradford and Sheffield, besides many other places, we shall probably learn before long to what extent the biological processes are interfered with by these effluents, and also the means by which this interference may be checked or altogether counteracted.

Standard Effluents.

The difficulty with regard to standard effluents remains to be considered. The conditions under which those standards have to be determined are so various, and there is so much difference of opinion with regard to them amongst authorities that it seems impossible to define them; although they would greatly facilitate the labours of all those who are concerned with the prevention of pollution. The details of these difficulties were discussed at Edinburgh by Dr. Wilson, who considers that the establishment of a standard is impracticable.

With regard to sewage, however, the principle on which a standard of purity should be formed may be defined; viz., that the effluent shall be purified in such a way that it will not undergo offensive putrefaction either by itself or when mixed with the stream into which it flows. With regard to trade effluents it is to be hoped that the present Royal Commission will lay down some definite lines. Meanwhile the temporary settlement of standards might be made in friendly conference between manufacturers and rivers committees, as has been done in some instances with satisfactory results.

Defects in the Act of 1876.

We will now consider the law, as it stands, for the prevention of pollution.

Why is the Rivers Pollution Act of 1876 almost universally condemned as a dead letter?

It has been pointed out again and again that this failure is due chiefly to the faulty and imperfect arrangements for the administration of the law, and to certain defects and difficulties in the Act itself.

"The powers for taking action against pollution were entrusted to the sanitary authorities, and these powers are enabling, not compulsory. Now, considering that the sanitary authorities are too often the greatest pollutors, and are constantly subjected to the influence of local and vested interests,

and the incessant cry for the reduction of the rates, it is not to be wondered at that the administration of these acts has not been attended with success."*

County Councils.

Great hopes were entertained that, with the establishment of County Councils by the Act of 1888, the indifference and opposition of interested or ignorant individuals and of the smaller local authorities would be overwhelmed and carried along by the larger and more powerful organisation. Unfortunately the administration of the law for the prevention of pollution, which is still purely optional, is from its very nature unpopular, and likely to be avoided. It can only be carried out thoroughly by men who will systematically devote much time and care to this duty, and will not be unduly influenced by local and vested interests, or by the clamour of short-sighted and parsimonious ratepayers.

Several of the County Councils, no doubt, have done, and are doing much for the prevention of pollution. But all efforts for improvement must be hampered and curtailed by the defects and difficulties at present existing in the Act of 1876, as well as by the obstacles in the way of administration.

What are those defects and difficulties? Chiefly as follows:

1. The vagueness and incompleteness of many of the terms, such as the definitions of polluting matters, liquid sewage, &c. (clauses 2 and 3).

2. The expense, delay, and uncertainty involved in the restrictions imposed when any authority proposes to enforce the enactment for preventing pollution.

3. The absence of deterrent penalties.

4. The absence of power of entry for the purpose of taking samples.

These defects are a serious impediment to action, as the joint committees of the Mersey and Irwell and of the West Riding of Yorkshire soon discovered, when they began seriously and systematically to deal with the overwhelming sources of pollution which prevailed in their respective districts. No time was lost by these committees in appealing to Parliament for special Acts, "To make more effectual provision for prevention of pollution," on the ground that "the restrictions contained in the Act (of 1876) were such as to preclude effective action."

Parliament acknowledged the justice and the reasonableness of the appeal by giving assent, and the necessary Acts were passed.

---

* "Waterborne Typhoid Fever." Jour. San. Inst. Vol. XIX, p. 248.

Now it is quite certain that everyone, local authorities, or individuals in the kingdom who have concerned themselves with the abolition of iniquitous pollution must have felt the necessity of these reforms, the remedying of the defects which I have mentioned.

And yet a Bill, a private Bill, which embodies all these reforms has been before the House of Commons for years.

This Bill, modelled on the Acts of the Mersey and Irwell Joint Committee and the West Riding Rivers Board, remedies the defects which I have mentioned. It defines and catalogues the various possible kinds of polluting effluents, grants powers of entry to authorities for the taking of samples, and whilst it amply protects the manufacturer from undue embarrassment and expenditure, provides for the proper administration of the law, and the infliction of appropriate penalties upon actual offenders with as little cost, delay, and uncertainty as possible.

Dr. Maclean Wilson, in his introduction of the discussion on Rivers Pollution at Edinburgh, pointed out that "the Bill as it stands at present is weaker in several respects than either of the Acts upon which it is based."

Dr. Wilson also goes on to say: "The following are some of the points left undecided by the present Bill: the settlement of the question of the right of a manufacturer to discharge his trade refuse into a public sewer, or of the right of the sanitary authority to refuse to allow him so to discharge it; the prohibition of the sludging of mill dams; the power to cause obstructions to the flow of stream to be removed; the absolute prohibition of any new pollutions; the proper supervision of the discharge of compensation water."

These details, it must be admitted, are of first-rate importance, and any conclusions dictated by the experience of these two active rivers Boards is bound to command attention and respect.

On the other hand, one cannot be too careful about overloading any proposed reforms with contentious details. It will be for those in charge of the Bill to decide whether and how many of these additional clauses should be added.

The Bill has been for some years under the care of Sir Francis Sharp Powell, one of the Vice-Presidents of this Institute. Sharing the fate of many private Bills, it has been talked out and shelved again and again. But Sir Francis intends it to pass; and pass it will. The reforms contained therein will be acknowledged by every intelligent person who studies them, as necessary and just. The time has come when we cannot any longer do without these reforms, and I trust that this Institute

will give loyal support to its indomitable Vice-President, by sending a strong, competent and representative deputation to the Local Government Board, at the earliest opportunity, begging the Board either to adopt this Bill, or to introduce one of its own, on the same or similar lines in the next session of Parliament.

The amendment of these intrinsic defects in the Rivers Pollution Prevention Act, will without doubt greatly facilitate and promote the abolition of much of the lawless and disreputable pollution which prevails throughout the United Kingdom.

There still remains, however, the great difficulty of getting councils, boroughs, and county boroughs to combine and insist that the law shall be duly observed throughout the whole watersheds in which they are situated. A Borough or a County Council may do its best to set its own house in order to prevent and abolish all pollution within its borders, but it is almost powerless to remove pollution—except when of the grossest and most intolerable kind—in parts of the stream and rivers which are higher up.

The sources and tributaries of a river, for instance, which are above a given town or county, may each contribute its share of pollution until the sum total of impurity in the main stream becomes intolerably offensive. Yet it will be very difficult to bring conviction home to the individual offenders.

The solution of the difficulty lies in the formation of joint committees, who shall have the supervision and control over whole watersheds, or groups of streams and rivers; committees which shall be fairly representative of all the local interests concerned—of Councils and water companies, manufacturers, and industries,—strong and extensive enough to resist the undue influence of local interests and local jealousies, and to overcome the *vis inertiæ* of ignorance and indifference; and whose sole business it shall be to administer the law promptly and without fear or favour for the protection of the waters within their district.

This is no paper scheme based on mere theoretical considerations. The Act of 1888 provides for such an organisation in Clause 81, whereby the formation of such joint committees is sanctioned and regulated.

The idea of the watershed as a proper area for administration is not at all new, but has been advocated by many competent authorities.

In April of this year Mr. Middleton read a very interesting paper to the Institute on the desirability of making watershed areas and sanitary districts coterminous. This proposition, however commendable, involves such a revolution and such an

intricate shifting and resetting of our whole social organisation, that it is not likely to find much favour. But for the constitution of joint committees for the prevention of pollution no new authorities are required. The existing authorities, who have not sufficient time, and who for reasons previously mentioned are not well qualified to carry out the work thoroughly, will merely depute their office to an authority provided for and sanctioned by the existing statute.

From the study of a map, showing the principal watershed areas in England and Wales, it will be seen that these areas differ greatly in size. In some cases (*e.g.*, Cornwall) a conjoint committee is evidently undesirable. And in various cases the County Council would be the more suitable central authority, as advocated by Dr. Reid. But in that case it would be desirable to depute this work to a special representative Board.

Fortunately there are joint committees, two of them established long ago which, in their constitution, methods of work, and results produced, present excellent models for the whole kingdom, viz.:—The joint committee known as the Thames and Lee Conservancy Boards, the Mersey and Irwell Conjoint Committee, the West Riding River Board, and the Ribble Joint Committee.

The methods employed and the results obtained by these Joint Committees are, I believe, but little known throughout the kingdom, and as I have been studying this subject for some time I will summarise as briefly as possible the information which I have acquired.

This gives me the opportunity of recording my grateful thanks to those gentlemen who are most actively engaged in the administration of the work of these boards for the courteous and candid manner in which they have put all available information at my disposal, viz., to Mr. Gough, Secretary of the Thames Conservancy Board; Major Lamorock Flower, Sanitary Engineer of the Lee Conservancy Board, and to Mr. Tatton, Dr. Maclean Wilson, and Mr. Naylor, Chief Inspectors of the Mersey and Irwell, West Riding and Ribble Joint Committees.

The Thames Conservancy Board is a representative body consisting of thirty-eight members appointed or elected by the Admiralty, the Board of Trade, the Trinity House (for control over the "lower navigation" especially), by eighteen County Councils and Boroughs (including the London County Council), the Corporation of London, the Metropolitan Water Companies, by ship-owners, owners of sailing barges, dock-owners and wharfingers.

It is the oldest authority for prevention of pollution, powers

for this purpose having been conferred upon it by Act of Parliament in 1866.

Originally these powers were limited to the main stream, and to the parts of its tributaries within three miles of the main stream.

By subsequent Acts these powers were extended to ten miles up the tributaries; but even then were found to be inherently defective as it was necessary to prove that pollution reached the main stream, and this was most difficult to do to the satisfaction of Magistrates.

Evidence was given before Lord Balfour's Commission in 1892 to this effect, and a recommendation was made by that Commission that powers should be extended to every part of the Thames Basin and that it should be an offence to pollute a tributary irrespective of the point whether the pollution reached the main stream.

This recommendation was carried into effect by the Thames Conservancy Act of 1894, which reconstituted the Thames Conservancy on lines more representative than theretofore.

The Conservators now have jurisdiction for prevention of pollution to the very sources of the Thames and its tributaries, an area of nearly 4,000 square miles above the western limit of the Metropolis, as well as within narrowed limits below that point.

In the tideway great results have been effected by the manner in which the London County Council have treated the sewage of London. This, which was formerly discharged untreated into the river, is now dealt with in precipitation tanks and the solids are carried away to sea instead of passing into the Thames.

Above the tideway, or rather above the western limits of the Metropolis, the 4,000 square miles above referred to, the Conservators have a chief inspector, seven igspectors and eight assistants, whose work is divided into seven districts, an inspector and an assistant each working in one of these. Bicycles are used as a means of rapid transit.

Reports are received from those officers on every town, village, and hamlet in the area.

Notices have been served on all persons polluting, and reasonable time is given to carry out works for diversion. About 5,000 inspections are made yearly. Samples are constantly taken and analysed by the Thames Conservator's Analyst, Mr. C. E. Groves, F.R.S. These analyses now amount to 1,800 a year. The results of the Conservators' action are as follows, a large part of which have been carried out during the last four years.

Summary showing the results of the action taken by the Conservators.

ABOVE THE INTAKES of the Metropolitan Water Companies.	Places.	Population.	Percentage of whole Populat'n.	No. of Inspections in 3½ years.
No Pollution discovered	590	210,705	19·3	5,480
Pollution diverted	362	437,423	40·0	6,122
Pollution not entirely diverted, but in course of diversion	107	254,818	23·4	2,583
Pollution not diverted	86	189,161	17·3	2,408
	1,145	1,092,107	100	16,593
BELOW THE INTAKES of the Metropolitan Water Companies, but above the Western limits of the Metropolis.				
No Pollution discovered	19	6,248	1·2	121
Pollution diverted	52	334,750	65·7	1,086
Pollution not entirely diverted, but in course of diversion	24	147,634	29·0	449
Pollution not diverted	10	20,917	4·1	164
	105	509,549	100	1,820

Mr. Groves says (June, 1898): "I might here point out that, owing to the action taken by the Thames Conservancy under the Act of 1894, the amount of organic impurity dissolved in the water immediately above the intakes is now only about two-thirds of what it was before the passing of that Act."

On the authorities who have not taken action, the Conservators are bringing pressure by proceedings before the Magistrates with great success.

The above statements will serve to give some idea of the methods of work and results attained by a conjoint committee of the largest and most important watershed in this country.

Not a spring, brook, or stream flows into our greatest river that does not come sooner or later under the supervision of the Board's inspectors; and it is difficult for the slightest pollution to escape detection.

Much still remains to be done, for even from prehistoric times individuals and communities have clustered on the banks of the Thames and its tributaries, each to contribute its share of filthy refuse to the stream; and owing to the rapid growth of village, town and city in the present century, more than a million souls inhabit the banks of the tributaries or main river above the intakes, and more than five million below the intakes of the London water companies:—a total equal to nearly one-fifth of the whole population of England and Wales.

For the abolition of such widespread pollution, time is of necessity required, partly owing to the legal subterfuges through which offenders can escape from the performance of their duties, partly from actual local difficulties of dealing with sewage (such as are due to clay soil, lowness of level, etc.), and partly because of the uncertainty which prevails with regard to the best practical means available for purifying the effluents.

Nevertheless the great work of purification progresses steadily, and it hardly needs the analysis of the chemist to show how greatly pollution has decreased since the Conservancy Board was entrusted with the task of preventing it.

The history of the prevention of pollution as carried out by the Thames Conservancy Board plainly shows the great advantages to be gained by a combination of representative authorities on a large scale—through which combination economy and effectiveness are secured.

By obtaining control over the sources and tributaries of the river immense advantages are gained, much constant and futile litigation is replaced by authoritative and successful action, and consequently much time, labour, and money are saved.

Such desirable results it appears are almost impossible to obtain through the action of isolated and comparatively weak local authorities.

The Lee Conservancy Board.

The jurisdiction of the Lee Conservancy Board extends over the whole watershed area of the River Lee, an area of nearly 600 square miles. The main river and all its tributaries are under the control of the Board, and provide a water supply to nearly two and a half million individuals.

The present Board of Conservancy was established by the Lee Conservancy Act of 1868, and resembles the Thames Conservancy Board in its representative character.

A very interesting account of this Board and its works, together with a graphic description of the River Lee, its tributaries, and surroundings, is to be found in the excellent paper entitled "The River Lee up to Date," which was written by Major Lamorock Flower, especially for the Sanitary Institute in 1893. From this history many most useful and practical lessons may be learnt.

The inspection, the patrol, the safeguarding of this important river, from the main stream up to its smaller contributing sources, have during the last seven-and-twenty years been carried on by one individual—Major Lamorock Flower himself.

Major Flower has always advocated individual action, in pre-

ference to action by committee, for securing the abolition of pollution. He has insisted that a competent man entrusted, empowered, and controlled by the constituted Board, can through his personal influence, guided by tact and judgment, succeed far better in inducing polluters to abate their nuisances than mere ordinary officials, instructed by resolutions of committee, and armed with the hateful legal notice, which usually excites the wrath and all the combative tendencies in him upon whom the notice has been served.

By exploring the valley of the Lee, either on foot or by water, you may see with your own eyes continuous evidence of pollution which has been diverted, or which is incessantly kept back, through the energy and watchfulness of the Board's entrusted agent.

The history of the river Lee also illustrates the fact that much pollution of our streams and rivers is often caused unconsciously by owners of adjoining land or house property; and that such persons, when their offences are brought before them by the right person, and in the right manner, are, in many cases, only too ready to remedy the evils for which they have unknowingly been responsible.

One blot in the Lee Conservancy Act cannot be passed unnoticed, viz., the clause which allows the carriage of house refuse, manure and gas lime on the river, generally in very old and leaky barges.

With regard to economy and cost. It might be thought that for the provision of such extensive and incessant supervision and control, a very large expenditure would be involved.

Such, however, is far from being the case, when the supervision and control are carried on under the direction of combined Boards, especially if we consider the vital importance of these measures, and the vast number of people who are thus protected.

In the case of the Lee Conservancy at any rate the total annual expenditure for all this supervision, inspection, and prevention of pollution, amounts to a sum, which, if charged to the water consumers, would be represented by a rate of a small fraction of a penny per annum.

The Mersey and Irwell Joint Committee and The West Riding Rivers Board.

These two joint committees were constituted by Provisional Order of the Local Government Board; the former in 1891, the latter in 1893.

The Mersey and Irwell Joint Committee consists of representatives of the Counties of Lancaster and Chester, and

of the County Boroughs of Bolton, Bury, Manchester, Oldham, Rochdale, Salford, and Stockport, representing in 1898 a population of nearly 2¼ millions. The West Riding Board consists of members elected by the West Riding County Council, and by the County Boroughs of Leeds, Sheffield, Bradford, Halifax, and Huddersfield.

Each of these conjoint committees soon found out how defective the Rivers Pollution Act of 1876 was, and almost within a year after their constitution sought for and obtained special Acts, upon the ground that "the restrictions contained within the said Act (1876) are such as to preclude effective action by the joint committee."

It is on these two private Acts (which are almost identical) that the Bill of Sir Francis Powell is modelled.

Now whilst the Thames and Lee Conservancy Boards have to deal almost entirely with domestic sewage, the task and difficulties of the Conjoint Committees of the Mersey and Irwell and of the West Riding are enormously complicated by the great preponderance of "trade effluents," by a mass of pollution which has rapidly accumulated during the last twenty or thirty years, and by the large and powerful industries which they are called upon to tax and correct in order to obtain right and lawful purification of the polluting effluents.

Thus Mr. Tatton, Chief Inspector of the Mersey and Irwell Board, reports in 1898, 90 sewage effluents in his district, 210 trade effluents passing into sewers, and 410 into rivers, whilst in the West Riding, Dr. Wilson reports 332 sewage disposal works and 2,103 trade effluents, 806 of which pass into sewers, and 1,297 into streams.

METHOD OF PROCEDURE.

The method of procedure of each of these Committees appears to have been very much the same :—

1st. A considerable time was spent in inspecting, surveying, reporting, and classifying the various effluents throughout the whole district. At the same time manufacturers were approached in a friendly spirit, advised where they were transgressing the law, and made acquainted with the powers of the Conjoint Committee.

The effect of these steps has generally been to bring about a considerable amount of voluntary reform and improvement.

The next step has been to send round notice requiring that a scheme for the purification of the trade effluents should be adopted where it was required. From this further improvements have resulted.

After allowing due time pressure has been brought to bear, and ultimately action has been taken in cases where the offenders omitted or refused to comply with the requirements of the Board.

In this way steady though slow progress has been made.

So far as I can judge from the evidence before me, every consideration has been shown by the Committees to the manufacturers, so as not to embarass them unduly or interfere unfairly with their industries, ample time has been allowed for elaborating schemes for purification, and every possible assistance and advice has been given by the Committee to help in the accomplishment of this oftentimes difficult and complicated task.

On the other hand, the manufacturers, as a rule, appear to have met the committees in a liberal and fair spirit, although to many of them the cost of constructing works has been very considerable.

In the West Riding definite improvement is already evident in the manufacturing and sewage pollutions, and more especially in the solid pollutions, although the Board has been in action for a comparatively short period.

The fine laboratory of the Board which was brought into use in September, 1897, gives every facility for analysis of sewage effluents and trade refuse. On visiting there in June, through the kindness of Dr. Wilson and Mr. Halliwell, I had the opportunity of studying a most instructive pathological collection of nearly every kind of foul trade refuse. Experiments on the treatment of these effluents are being carried on in the laboratory and it is hoped that the experimental work will be of great use to manufacturers in assisting them to discover the best means of purifying their trade refuse.

In the Mersey and Irwell District, which had two years start of the West Riding, the resulting improvements are still more marked.

Very few trade effluents remain untreated. The upper tributaries of the rivers are palpably clearing. The deposits of cinders and sludge lower down are very much diminished. It is encouraging to find that the manufacturers are already benefitting in that the water supplied to them requires less sedimentation and filtration before use in their mills, &c., whilst the foul materials which used to pollute the river are in several instances recovered with profit to the manufacturer, notably in paper making and coal washing, thus illustrating the wise adage that "dirt is but matter in the wrong place." In all probability it will be found that materials of some value

may be extracted from most trade effluents. In fact as Shakespeare tells us:

> "There is some soul of goodness in things evil,
> Would men observingly distil it out."

All this seems almost too good to be true.

If such improvements can be produced in the face of such difficulties, there seems no reason why the purification of our streams and rivers should not be accomplished quickly and steadily, if the Act of 1876 be reformed in the few necessary details, and if conjoint committees, organised on the same lines as those of the Thames, Lee, Mersey and Irwell, West Riding and Ribble, having control over whole watersheds, or groups of streams and rivers, be established throughout the country.

The Ribble Joint Committee.

The history of the Ribble Joint Committee, which was constituted by Provisional Order in 1891, illustrates the great advantage of placing a whole watershed area (or the greater part of it) under the control of a joint committee, even if no special Act be obtained for the district. The reduction and abolition of pollution has steadily progressed in this watershed; in many cases profit has been gained by purifying the effluents; whilst it is claimed that under the Act of 1876, with all its defects, the good work of the Ribble Conjoint Committee compares not unfavourably with that of the other Boards.

In the remarks which I have been privileged to make to you I feel conscious of many omissions and defects, but I trust that you will make some allowance on account of the magnitude and complexity of the subject compared with the short time at my disposal. Amongst other things the pollution of our wells and subsoil water, which is undoubtedly the cause of most "water-borne typhoid fever," is a subject of such vast importance that it could not be dealt with in the same lecture.

It is impossible, however, to pass over the burning question of the responsibilities of waterwork companies and the relations of those companies to sanitary authorities.

The following resolutions, which I proposed at the discussion on "Waterborne Typhoid," in March, were carried unanimously, and are at present under the consideration of the Council:—

That the Council of the Institute be requested to consider the best means for obtaining new and effective legislation for the protection of our water supplies from pollution, whereby it shall be enacted that—

(1) All local Sanitary Authorities shall have free access to

the water supplies—from source to distribution—which are distributed within their districts, whether the source and course of the water so supplied be within their district or not. That the Sanitary Authorities provide for the thorough and regular inspection of the water supplies distributed within their districts, and for the regular analysis of such water, as often as may be deemed sufficient, and that the results of such inspections and analyses shall be regularly recorded and published,

(2) That the waterworks companies shall prepare and publish records of their water supplies; such records containing a full account of every source and tributary of the water supply, and a full account of all reservoirs, conduits, filter-beds, mains, and pipes by which the water which they supply is collected, stored, or conveyed, to the houses supplied; such records also being fully illustrated by maps, plans, and sections, showing the relation of all houses, drains, sewers, cesspits, and all deposits of organic refuse in the immediate neighbourhood of any part of the water supplied by them, and that all such records, maps, plans, sections, &c., shall be freely accessible for the purposes of inspection to the sanitary authority within whose district the water is supplied, and to every customer of the waterworks company.

(3) That the Water Companies shall be required to make regular, constant, and thorough inspection of all parts of their waterworks—from source to distribution—with a view to preventing wilful, careless, or accidental pollution; also to make regular analyses of the water supplied by them, so often as may be considered necessary; and to make and publish reports of all such inspections and analyses.

(4) That Waterworks Companies shall be made responsible for the consequences of the pollution of water supplied by them, if such pollution could reasonably have been prevented.

(5) That wilful or careless pollution of any water supply shall be regarded and treated as a penal offence.

We have been accustomed to rely chiefly upon our waterwork companies for securing us against the introduction of poisonous material into the water with which the companies supply us, and which we have to drink, if we drink any water at all.

But under the existing state of the law the obligations laid on the companies are so insufficient that we have no ground for such confidence.

The disastrous epidemics which have occured in recent times have opened the eyes of the public to this fact, and roused them from their indifference to such an extent that the necessary reforms will be insisted upon at the earliest opportunity.

Parliament also appears to be ready for action, for although the clauses proposed by Mr. Chaplin last June, to be added—with a view to protecting the consumers—to twenty-one private water bills were withdrawn, the withdrawal was urged upon technical grounds, and all who spoke on the subject appeared to be ready to support those clauses if introduced in a public bill.

On looking at these clauses of Mr. Chaplin's, I am astounded to find that the provision which, in my mind, is by far the most important one has been entirely omitted;—viz., the regular and constant inspection and supervision of all parts of the water-supply—from source to distribution.

Instead of that the taking and examination of samples is entirely relied upon for the detection and prevention of pollution.

Combined with thorough and regular inspection of the water-supply, it is true, chemical and bacteriological analysis can be of great service, for they can give indication of pollution which could not be detected merely by inspection.

If relied upon alone they give a false sense of security.

Even if the analyses were made daily they would not enable us to prevent pollution, they can only detect the pollution after it has taken place.

As a rule water-borne outbreaks of typhoid fever occur with explosive violence; so that most of the victims have imbibed the poison before the alarm conveyed by the means of analysis can possibly save them from infection.

It is to be hoped that these reforms will be carried out as soon as possible, and that the serious omission with regard to inspection will be remedied.

I trust, however, that amidst the agitation which springs out of recent calamity and alarm the old standing evil will not be forgotten; that the nation will awake to a sense of the disgrace, loss, and danger which must always exist as long as this foul and illegal pollution of our streams is suffered to continue.

If the idea of constituting joint committees to control whole watersheds or groups of streams, according to circumstances and convenience, be approved of, I appeal to the Institute, to this Congress, to all concerned in the health and welfare of the nation, to do all that is possible to urge the Local Government Board that they shall give every facility and encouragement for the formation of such joint committees. But, above all, I hope and trust that you and all who are so concerned will give cordial support to the Rivers Pollution Prevention Bill by which the defective Act of 1876 will be amended, and through which we may hope eventually for the total abolition of the pollution of our streams and rivers throughout the United Kingdom.

POPULAR LECTURE,

By ALEX. HILL, M.A.Camb., M.D., M.R.C.S., J.P.,
Master of Downing College, and Vice-Chancellor
of Cambridge University.

UNNATURAL DEATHS.

ABSTRACT.

Dr. Hill said that the normal longevity of human life probably might be put at 100 years. Yet the average longevity in England and Wales was less than fifty. Of every million babies born in England and Wales 30,000 would die a violent death by crime or misadventure, about the same number would die of that mysterious disease of which we knew so little that we could hardly regard it yet as preventible cancer, while 240,000 would die of diseases which we knew now to be absolutely preventible because they were infectious—that is, due to germs. Practically a quarter of all the children born in England and Wales would die from absolutely preventible causes. If the practice of hygiene were only on a level with its science, the average longevity would be raised at once from fifty to sixty-five. A large number of diseases were due to individual mismanagement of the system. Nearly all of these were due to mistakes in feeding and drinking. He was not a teetotaler, and he was not a vegetarian, but if a man could not take alcohol without becoming a drunkard he had better become a teetotaler, and if he could not check his appetite for meat until gout had him in its clutches, he had very much better be a vegetarian. A Frenchman, as soon as the flavour ceased to make an impression upon his palate, ceased eating; an Englishman liked to eat in order to enjoy the feeling of repletion. Fastidiousness favoured moderation. A sensible clock might

have qualms as to what would happen if it were not wound up at the proper time, but it would never during the course of the day give its pendulum a sudden jog. That, after all, was the effect of a nip of spirit taken between meals.

Why were these diseases, if preventible, not prevented? Our knowledge was very recent—scarcely ten years old some of it. The good time was coming, but it would not come until both the medical officers and the public had a clear and perfect realisation of the germs which produced disease. St. Peter spoke of "the adversary" as a roaring lion, but if he had lived in these days he would probably have compared him to a microbe.

The Lecturer showed, with the aid of lantern enlargements, how these "criminals" were caught and caged, and, like human criminals, photographed in order that pathologists might learn their habits, and discover how to prevent them from doing further mischief. He also spoke of the part the white corpuscles of the blood—150 millions of living creatures in every man or woman—played in capturing and destroying the germs of disease. Showing the typhoid fever germ, he said that such a germ ought no longer to be in existence. There were some diseases which we could not trust our white corpuscles to overcome—cholera, the plague, and typhus, for instance. Another was responsible for 120,000 deaths out of every million—tuberculosis, which appeared in various forms, according to the part it attacked. The disease was infectious, and the only way to secure oneself against it was to shun sources of infection. To those who had to nurse consumptive patients, the best protection was ventilation and disinfection. The disease was not hereditary, although some people exhibit a constitutional tendency to take it.

One important source of infection is milk; for it appears that cows kept in byres are extremely liable to tuberculosis. One-third of the cows from which we derived our milk supply were tuberculous, and, as the milk was mixed, one-half of the milk was infected. He always boiled his milk, but he could not boil the butter. The rush to Berlin when Koch discovered his "cure" was one of the grimmest mistakes in the history of medicine. Tuberculin could not cure consumption, but a tuberculous patient "reacted" to it. Thus it could be made a means of detecting the disease. In Denmark it was used in the byres: the cows which "reacted" were separated from the healthy ones, and their calves were fed upon the milk of the latter until the disease had been almost stamped out in that country. He could promise a fortune to any dairy-farmer who would take a similar course, and supply milk guaranteed to come from

ch had been tested by competent Veterinary Surgeons
l not to react to tuberculin. Tuberculosis was of slow
ent, and the infection might not be discovered until
fter it took place.
talked of consumption being brought on by a chill. To
ny disease being due to a chill was stuff and nonsense.
said "a chill" when they did not know what to say,
ople used to talk about the evil-eye. The chill might
tention to the disease, or even be the cause of its
e manifestations, but it never caused it.

CONGRESS AND EXHIBITION AT BIRMINGHAM.

Report of Closing Meeting.

The closing meeting of the Congress was held on September 30th, Sir Joseph Fayrer, Bart., K.C.S.I., M.D., LL.D., Q.H.P., F.R.S., in the Chair.

The Chairman read a letter from Sir Henry W. Acland, Bart., K.C.B., F.R.S., regretting that he was too ill to have attended the Congress, and urging the interest of the Congress in establishing at Oxford facilities for the training of University men specially for Public Health Work in India.

Reports of the work done in the different Sections and Conferences of the Congress, and the Resolutions passed, were read by the respective Secretaries, and the Resolutions were referred to the Council of the Institute for consideration.

Proposed by Sir Joseph Fayrer, Bart., K.C.S.I., F.R.S., seconded by Major Lamorock Flower:—

Resolved—"That the Sanitary Institute and members of the Congress desire to express their most sincere thanks to the Right Hon. the Lord Mayor and to the Lady Mayoress and the Corporation of Birmingham, for the cordial manner in which the Congress has been received, and for the personal kindness and hospitality extended to the members."

Proposed by Alderman W. Cook, J.P., seconded by Dr. J. F. J. Sykes:—

Resolved—"That the hearty thanks of The Sanitary Institute and the Congress be presented to the Council and Managers of the Mason University College, and the Birmingham and Midland Institute, for their courtesy in placing at the disposal of the Congress handsome and suitable buildings for the various meetings."

Proposed by Dr. George Reid, seconded by Mr. E. G. Mawbey:—

Resolved—"That the hearty thanks of the members of the Congress be given to those who have so kindly shown hospitality at private receptions, by privileges accorded to members at the various Excursions, which have added so greatly to the pleasure and enjoyment of the meeting."

Proposed by Dr. Bushell Anningson, seconded by Dr. H. R. Kenwood :—

RESOLVED—"That the earnest thanks of the Congress are due to the Local General Committee, the various Sub-Committees and Local Secretaries, for their arduous labours in their several departments, and for their unremitting exertions in carrying out the many details in the organization of the Congress, which have culminated in such a successful meeting."

Proposed by Mrs. Bassett, seconded by Mr. W. Bayley Marshall :—

RESOLVED—"That the thanks of this meeting are due to the members of the Press for the reports which have been published of the proceedings, and which are largely instrumental in the dissemination of the teachings of the Congress."

Proposed by the Right Hon. the Lord Mayor, seconded by Councillor Lloyd :—

"That the cordial thanks of the Congress be hereby presented to the President, Sir Joseph Fayrer, Bart., K.C.S.I., F.R.S., for the interest and courtesy he has displayed in presiding over the Congress and attending the numerous meetings."

The total number of tickets issued was 1977 (see report on page 486).

BIRMINGHAM EXHIBITION, 1898.—LIST OF AWARDS.

SILVER MEDALS.

Adams & Co., York.
Adams' Automatic Sewage Lift.
Allports, 21 & 23, Colmore Row, Birmingham.
Jaeger Woollen Underclothing.
Burroughs, Wellcome & Co., Snow Hill Buildings, London, E.C.
Case for Water Analysis, and Chemicals in Soloids for Water Analysis.
Burroughs, Wellcome & Co., Snow Hill Buildings, London, E.C.
Compressed Chemical Substances.
Burt, Boulton & Haywood, Ltd., 64, Cannon Street, London, E.C.
Products of Coal Tar and Ammoniacal Liquor.
Cadbury Brothers, Bournville, near Birmingham.
Cocoa.
F. C. Calvert & Co., Bradford, Manchester.
Pure Carbolic Acid.
The Cannon Hollow Ware Co., Bilston, Staffs.
Enamelled Cast Iron.
J. Defries & Sons, Ltd., 147, Houndsditch, London, E.C.
Pasteur-Chamberland Filter.
J. Defries & Sons, Ltd., 147, Houndsditch, London, E.C.
"Equifex" Pressure Disinfecting Apparatus.
Ferrybridge Foundry Co., Ferrybridge, Yorks.
"Fryston" Range.
J. S. Fry & Sons, Ltd., Union Street, Bristol.
Pure Cocoa.
Hughes & Lancaster, 47, Victoria Street, London, S.W.
Shone's Hydro-Pneumatic Ejector.
Maiche, Ltd., 4, St. Mary Axe, London, E.C.
Automatic Water Steriliser.
J. Stott & Co., Vernon Works, Oldham.
Mercury Gas Governor.
Jas. E. Webb, 52, Queen Victoria Street, London, E.C.
Vaillard Desmaroux Water Steriliser.
Wilson & Stockall, County Ambulance Works, Bury, Lancashire.
Brougham Ambulance.
Wilson & Stockall, County Ambulance Works, Bury, Lancashire.
Accident Ambulance.

BRONZE MEDALS.

The Adamant Co., Ltd., 6, Commercial Street, Birmingham.
Adamant Plaster for Walls and Ceilings.
Adams & Co., York.
Wedge Disc Valve.

Aerators, Ltd., Broad Street Avenue, London, E.C.
Methods of Aerating Water by means of Compressed Carbon Dioxide.
Arkinstall Brothers, Milk Street, Birmingham.
Simplex Cinder Sifter.
A. Boake, Roberts & Co., Ltd., Stratford, London, E.
Liquid Sulphur Dioxide for Disinfection.
Brion, Pate, Burke & Co., 15, Wallbrook, London, E.C.
Petanelle Fabrics.
Burn Brothers, 23, Charing Cross, London, S.W.
Expanding Drain Stopper.
Burt, Boulton & Haywood, Ltd., 64, Cannon Street, London, E.C.
Rapid Mixer for Liquids.
Callender & Montgomery, 11, Victoria Street, London, S.W.
Callender Pure Bitumen for Linings.
The Cannon Hollow Ware Co., Ltd., Bilston, Staffs.
"Perfect" Straining Cover for Cooking Utensils.
The Cannon Hollow Ware Co., Ltd., Bilston, Staffs.
The "Chef" Gas Cooker.
Chemists' Aerated and Mineral Water Associations, Ltd., The Rock Spring Works, Cheston Road, Aston, Birmingham.
Aerated Waters.
Clark's Optimus Coffee Co., Ltd., Queen's Road, South Lambeth, London, S.W.
Whitehead's Automatic Taps, for drawing off liquids.
Davis Gas Stove Co., Ltd., Camberwell, London, S.E.
Automatic Gas Stove.
A. R. Dean, Ltd., Corporation Street, Birmingham.
Low Pressure Ventilating Radiator.
A. R. Dean, Ltd., Corporation Street, Birmingham.
Fibrous Plaster.
J. Duckett & Sons, Ltd., Burnley, Lancs.
Louvre Air Bricks.
J. Duckett & Sons, Ltd., Burnley, Lancs.
Enamelled Glazed Urinals.
Eclipse Brass and Copper Co., Ltd., Harrison Rd. Works, Halifax.
Jackson's Self-Feeding Water Boiler.
Farrer, Barber & Co., 36, Cannon Street, Birmingham.
The "Helliwell" System of Glazing.
Farrer, Barber & Co., 36, Cannon Street, Birmingham.
Combined Sink and Lavatory.
Formalin Hygienic Co., 9, St. Mary-at-Hill, London, E.C.
Formalin.
General Institution for the Blind, Birmingham, Edgbaston, Birmingham.
Adaptation of the Braille System to Phonetic Reporting for the Blind.
W. Glover & Sons, Ltd., Eagle Works, Warwick.
New Rotary Watering Van.

W. HARRIMAN & Co., LTD., Fenkle Street, Newcastle-on-Tyne.
Floor Channels, with Sockets for Waste Pipes.

W. HARRIMAN & Co., LTD., Fenkle Street, Newcastle-on-Tyne.
Barron's Channel Bends, made to pass a Drain Plug.

A. HUGHES, 88, Moor Street, Birmingham.
Biscuits.

G. J. HUTCHINGS, 94, Clerkenwell Road, London, E.C.
Hutchings' Food Steamers.

C. ISLER & Co., Bear Lane, Southwark, London, S.E.
Tube Wells.

JEYES' SANITARY COMPOUNDS CO., LTD., 64, Cannon St., London.
Jeyes' Fluid.

JAMES JONES, 317, Albert Road, Aston, Birmingham.
Reversible Window with Lines and Weights.

E. N. KENWORTHY & Co., Alpha Works, Oldham.
Paragon Washer, Wringer, and Mangle.

E. N. KENWORTHY & Co., Alpha Works, Oldham.
"Equipoise" Wringer, Mangle.

BERNARD KÜHN, 36, St. Mary-at-Hill, London, E.C.
Chinosol.

LEEDS ART POTTERY AND TILE CO., Leathley Road, Leeds.
Wall Decorations in Leeds Faience.

C. A. LINE, Burlington Chambers, New Street, Birmingham.
Willesden Paper.

C. A. LINE, Burlington Chambers, New Street, Birmingham.
Tynecastle Canvas.

MELLIN'S FOOD CO., LTD., Peckham, London, S.E.
Mellin's Food for Invalids.

MOULD'S PATENT BOILER BATH CO., 3, Union Passage, Birminghar
Boiler Bath.

NEWTON CHAMBERS & Co., Thorncliffe, Sheffield.
Izal.

OATES & GREEN, LTD., Halifax.
Glazed Stoneware Manger.

OATES & GREEN, LTD., Halifax.
Salt-Glazed Wash-Tub and Rubber combined.

PARKER, WINDER & ACHURCH, LTD., Broad Street, Birmingham
Jones' Combination Bath.

PARKER, WINDER & ACHURCH, LTD., Broad Street, Birmingham
Ventilated Hot Closet for Eagle Stove.

W. PARKINSON & Co., Bell Barn Road, Birmingham.
Penny-in-the-Slot Prepayment Gas Meter.

PENDLETON SANITARY ENGINEERING CO., Leaf Square, Pendlet Manchester.
Dr. Quine's Ashbin.

W. W. ROLSTON, 120, Pope Street, Albion Street, Birmingham.
Thermometer for Hospital Wards.

ROWE BROS. & Co., City Lead Works, Clement Street, Birmingha
Lead Pipe made in any length.

SANITARY VENTILATING SYNDICATE, 40, Lower Ormond Quay, Dublin.
W.C. Ventilating Fan, worked by High Pressure Supply to Flushing Cistern.

SCHWEPPES, LTD., Colwall, Malvern.
Aerated Waters.

SHANKS & Co., Barrhead, N.B.
"Perfecto" Lavatory.

SHANKS & Co., Barrhead, N.B.
"Perfecto" Bath.

SILICATE PAINT Co., LTD., Charlton, London, S.E.
"Duresco."

SOUTHALL BROTHERS & BARCLAY, Lower Priory, Birmingham.
Aerated Waters prepared from Distilled Water.

STEAM CARRIAGE & WAGON Co., Homefield, Chiswick.
Steam Tip-Wagon,

STOCK, SONS & TAYLOR, Berkeley Street, Birmingham.
Hydraulic Ram with Valve.

SUMMERSCALES & Co., Phœnix Foundry, Keighley, Yorks.
Improved "Challenge" Ironing Machine.

SUMMERSCALES & Co., Phœnix Foundry, Keighley, Yorks.
Washing Machine for Disinfecting under Steam Pressure.

SUTTON & Co., Union Pottery, Overseal, near Ashby-de-la-Zouch.
Green's Wyvurst Channels and Inlets for Manholes.

TWYFORD'S LTD., Hanley.
"Axis" Water Closet, with screw brass joint.

TWYFORD'S LTD., Hanley
Triple Vegetable-Sink.

TWYFORD'S LTD., Hanley.
"Ideal" Sink in two compartments.

UNITED ALKALI Co., LTD, Gaskell and Deacon Works, Widnes.
Chloros.

VIMBOS LTD., 130, Queen Victoria Street, London, E.C.
Concentrated Vimbos.

WHITELY HEALTH EXERCISER, LTD., 29, Maltby Street, Bermondsey, London, S.E.
"Whitely" Exerciser.

DEFERRED FOR PRACTICAL TRIAL.

WM. THOMAS ALLEN, Whitehouse Street, Aston Rd., Birmingham.
Automatic Flushing Tank.

T. ASH & Co., 37, Cannon Street, Birmingham.
"Acme" Ventilator.

A. BARRACLOUGH & Co., LTD., Eureka Lead Works, Heckmondwike.
Eureka Lead Water-pipe.

A. BOAKE, ROBERTS & Co., Stratford, E.
Lozar Disinfectant.

BURN BROTHERS, 23, Charing Cross, London, S.W.
Steam Heater for Hot-water Warming and Supply.

BURN BROTHERS, 23, Charing Cross, London, S.W.
A Court & Binny's System of Hot-water [illegible] nd Supply.

J. Duckett & Son, Ltd., Burnley, Lancs.
Automatic Grease Flusher.
J. Duckett & Son, Ltd., Burnley Lancs.
Automatic Syphon Cistern.
Evered & Co., Ltd., 27, Drury Lane, London, W.C.
Automatic Flushing Tank.
Farrer, Barber & Co., 36, Cannon Street, Birmingham.
Automatic Flushing Tank.
Hughes & Lancaster, 47, Victoria Street, London, S.W.
Fischer System of Water Filtration.
Geo. Jennings, Palace Road, Lambeth, London, S.E.
Duplex Supply and Sanitary Waste Valve.
G. Jennings, Palace Wharf, Lambeth.
Joinder for Branch Drains.
Fred Lomax, 27, Freeman Street, Birmingham.
"Viking" Condensed Milk.
Mansfield Patents Co., Queen Street Chambers, Mansfield, Nott
Chimney Pot.
Mansfield Patents Co., Queen Street Chambers, Mansfield, Nott
Mansfield Ventilator.
Martineau, Beames & Madeley, Holloway Head, Birmingham.
Pullen's "Scorcher" Paint Lamp.
Parker, Winder & Achurch, Ltd., Broad Street, Birmingham.
"Victoria" Ventilator.
Parker, Winder & Achurch, Ltd., Broad Street, Birmingham.
"Empress" Ventilator.
Parker, Winder & Achurch, Ltd., Broad Street, Birmingham.
"Standard" Ventilator.
A. Pickles & Co., City Soap Works, Wakefield.
Hammond's Drain Tester.
Plant & Co., 66, Dale End, Birmingham.
Zinc Roofing.
Protene Co., Ltd., 36, Welbeck Street, London, W.
"Protene" Food.
Septic Tank Syndicate, 7, Bedford Circus, Exeter.
"Septic" Tank.
Shanks & Co., Barrhead, N.B.
Non-concussion Taps.
G. Skey & Co., Wilnecote Works, Tamworth.
Spiralvent Chimney Top.
Sterilite Filter Co., 15, Haymarket Street, Bury.
Sterilite Filters.
Sutton & Co., Union Pottery, Overseal, near Ashby-de-la-Zouch.
Quarries for Heating Drying Sheds.
Twyford's, Ltd., Hanley.
"Twycliff" Syphon Closet.
J. E. Webb, 52, Queen Victoria Street, London, E.C.
"Excel" Silver.

HENRY LAW, *Chairman of Judges.*

REVIEWS OF BOOKS.

ENGLISH SANITARY INSTITUTIONS REVIEWED.*

It is with great pleasure that we again refer, in the pages of the Journal of The Sanitary Institute, to an historical work of lasting importance, the first edition of which appeared at the end of 1889. Two or three years before that date the Institute had undertaken the task of reproducing Mr. Simon's "Reports"—made, first as the Medical Officer of the City of London, and afterwards as Medical Officer of the Privy Council. These two volumes of "Public Health Reports" form part of the classical literature of the student of Sanitary science, taken in conjunction with the volume now issued for the second time. It would no doubt be difficult to find among the Fellows of the Institute any who are not already acquainted with the works of so great a writer on the medical sciences related to the preservation of the public health as Sir John Simon, F.R.S. But for the benefit of those who have become associated with the Institute during the last ten years, it is highly desirable that prominent attention should be drawn to literature which deals with subjects of the most profound importance to the State; for it is indeed as an official statesman that we must regard the first medical adviser of Her Majesty's Government, when we come to consider the influence of his work and teaching, and when we claim for his productions the place which is due to them among those of his greatest contemporaries.

"English Sanitary Institutions" may be said to consist of two parts. The first comprises chapters which have been described by eminent men and readers of all kinds as "fascinating" in character. Those on "Post Mediæval England" and "New Momenta" are written in the style which we most admire, with the same simplicity, power, and beauty of language as that which, half a century ago, compelled the attention of the nation to the gospel of "religion of mutual helpfulness." These are chapters which should form part of the higher education of every youth at the Universities and elsewhere amongst English speaking peoples. The passages describing the life of Francis of Assisi and his times, and those which depict the work of John Howard, are masterpieces of our language; indeed the whole of this section, which comprises 176 pages, forms one of the most interesting historical works that have been written.

The major part is devoted to the reign of Queen Victoria, during which period Sir John Simon and his coadjutors on the Privy Council and the Local Government Board took such a prominent part in the development of those Institutions, which Sir John himself undertakes the formidable task of reviewing. Of this part of the book it may

* English Sanitary Institutions Reviewed in their course of Development, and in some of their Political and Social Relations. By Sir John Simon, K.C.B., F.R.S. Second Edition. Smith, Elder & Co.

safely be observed that it is very fortunate it has been written. At the same time it would be impossible for us at present to attempt to appreciate its full value. We are living in a different age to that in which Mr. Simon did his chief life work, and are therefore the less able to view the subject matter, which he treats with so much care, entirely from his standpoint. Nevertheless, as we have already observed, it is for the statesman or ruler that the former chief medical officer now writes. For this reason we think that in these days, when public health considerations are becoming more and more subordinated to the exigencies of "Party," a work so full of information respecting our sanitary legislation, and the way in which it arose, should be studied by all politicians and representatives of local government in every department, as well as by those who from their position can do so much to form sound public opinion.

"English Sanitary Institutions" is a volume which all workers in local government and health service should possess, and it should be accessible to the public at every library maintained by the rates. The value of the present issue is enhanced by the addition of two very important Essays, entitled respectively "Ethical Relations of Man," and "Charitable Bequests Forbidden by Law."

E. S.

ARTICLES RELATING TO PUBLIC HEALTH,

Appearing in the chief British and Foreign Journals and Transactions.*

Abstracts of Titles classified in this List under the following headings:—

Science in Relation to Hygiene and Preventive Medicine.
Hygiene of Special Classes, Trades, and Professions.
Municipal Administration.
Building Materials, Construction, and Machinery.
Water Supply, Sewerage, and Refuse Disposal.
Heating, Lighting, and Ventilating.
Personal and Domestic Hygiene.

Science in relation to Hygiene and Preventive Medicine.

CAMERON, SIR CHARLES A., M.D., D.P.H. Presidential Address, Congress of Royal Institute of Public Health, Dublin. *The Journal of State Medicine*, September, 1898, p. 389.

Deals with the causes which raise the urban death-rates above those of rural districts; the state of the public health in Dublin; dwellings for the poor; and the prevalence of enteric fever in Dublin.

* A list of sub-headings is given on page 286, and a list of the Journals from which the Titles are selected is given on page 300.

GRIMSHAW, T. W., C.B., M.A., M.D. The Relations between Preventive Medicine and Vital Statistics. *The Journal of State Medicine*, September, 1898, p. 406.

Shows the necessary connection between vital statistics and preventive medicine, and indicates the main application of vital statistics as tests of the health of communities.

KELLY, R. J., Barrister-at-Law. The Existing Law: its possibilities. *The Journal of State Medicine*, October, 1898, p. 498.

STAFFORD, T. J., M.D. The Sanitary Acts and their Administration in Ireland. *The Journal of State Medicine*, September, 1898, p. 426.

MACGREGOR, ALEX., M.D., M.R.C.P. The Vitality of the Diphtheria Bacillus. *Lancet*, March 12th, 1898, p. 716.

Illustrating the presence of the diphtheria bacillus long periods after recovery from the actual disease, and in the absence of any trace of throat ailment remaining.

PFUHL, PROFESSOR E. Sur l'entrainement des Bactères par l'Eau Souterraine. *La Technologie Sanitaire*, Sept. 1st, 1898, p. 57.

Notes of experiments of the passage of bacteria through the soil in ground water (micrococcus prodgiosus and "Vibrious luisants").

WESBROOK, E. F., M.D.; WILSON, L. B., M.D.; MCDANIEL, O., M.D., and ADAIR, J. H., M.D. Bacillus Diphtheria and its Varieties in Schools where disease was endemic. *British Medical Journal*, April 16th, 1898, p. 1008.

Quite unable to account for disease from local conditions. Urge importance of bacteriological examination of throats of persons brought in contact with the disease on at least two successive occasions; also, that patients while suffering and while convalescent should, where possible, be quarantined singly.

BEVERIDGE, W., M.B. Hygiene in Plague. *The Journal of State Medicine*, July, 1898, p. 299.

Indicating the measures which should be taken to arrest the progress of the disease.

BUZZARD, THOMAS, M.D., F.R.C.P. Cases illustrating the Infective Origin of Infantile Paralysis. *Lancet*, March 26th, 1898, p. 847.

Cases related in which feverish symptoms have preceded the paralytic symptoms, and instances in which several cases of the disease have occurred at the same time and in the same locality, both fact

indicating the presumption "that infantile paralysis must be classed amongst infective diseases."

MEYER, SURGEON-CAPTAIN C. H. F. Plague Experiences at Hubli. *Lancet*, April 2nd, 1898, p. 937.

Gives an account of the methods adopted to stamp out an outbreak of plague.

PARKES, LOUIS, M.D., D.P.H. Mortality from Diarrhœal Diseases in London, 1861-97. *British Medical Journal*, May 28th, 1898, p. 1398.

Registrar-General's figures indicate that the disease registered as enteritis has climatic and seasonal relations similar to diarrhœa and cholera; and that, so far as young children are concerned, the inference is a fair one that these diseases own a common cause.

RANSOME, ARTHUR, M.D., F.R.S. Consumption a Filth Disease. *Lancet*, Jan. 1st, 1898, p. 14.

Proof by statistical and experimental evidence. Entirely preventable. Proposed preventive measures.

TURNER, H. G., M.D., M.R.C.P. Influenza and Immunity. *Lancet*, Feb. 5th, 1898, p. 363.

Immunity considered (1) as regards time and place, and (2) as it affects individuals. Conclusions (1) Protection afforded by an attack so short as to be clinically negligeable, and (2) there is evidence to show that there may be either a special susceptibility or an acquired predisposition.

McWEENEY, E. J., M.A., M.D. Etiology of Typhus Fever. *British Medical Journal*, April 2nd, 1898, p. 881.

Account of tests, by Gruber-Widal method, for discovery of micro-organisms in blood of two patients suffering from typical spotted typhus. Concludes that *materies morbi* cannot be found by present methods of investigation.

Hygiene of Special Classes, Trades and Professions, Municipal Administration.

GERHARD, WILLIAM PAUL. The Sanitary arrangements of Hospitals. *The Engineering Magazine*, April, 1898, p. 148.

Notice of a paper published in Albany (U.S.A.), *Medical Annals*.

BRUCE, WILLIAM. Working of the Housing of the Working Classes in Edinburgh. *Surveyor*, July 1st, 1898, p. 18.

The conditions of poorer tenements in Edinburgh. The question of cottages or tenements in flats. Sites for housing working classes. Rent in relation to wages, &c., &c.

SEE, JAMES W. Patents. *Engineering Record*, Vol. XXXVIII. Nos. 3 and 4, June 18th and July 9th, 1898, pp. 52 and 116.

General information as to scope and validity of patents. Precautions to be observed. Common errors.

BONI, GIACOMO, Hon. Corr. Member of the R.I.B.A. The Lagoons of Venice. *Journal of the Royal Institute of British Architects*, June 11th, 1898, pp. 389 to 394.

New streets in Venice. Clearing and regulating the canals. Bridges. Modern engineering works causing the lagoons to become more and more insanitary. Tidal motion impeded, and malaria increased. Dredge the canals, and deposit the mud upon low-lying ground beyond the lagoons. The paper is illustrated by a map, a bird's-eye view from a wood carving of the year 1500, and a view of the malarious marshes from the Belfry of Torcello.

KEELER, H. E. Municipal Franchise Contracts. *Engineering Record*, Vol. XXVIII., No. 4, June 25th, 1898, p. 75.

A plea for granting contracts for water supply on reasonable and mutual terms, safeguarding public interests and also private shareholders.

Building Materials, Construction, and Machinery.

HILLS, H. F., F.C.S. The Chemical Examination of Mortar. *The Builder*, Sept. 17th, 1898, pp. 244, 245.

Comparison of mortar from Bow Church and from Corfe Castle, the former made about A.D. 1490, and the latter about A.D. 1000.

MIDDLETON, G. A. T. Fire-resisting Construction — The Regulations in force in London. *The Engineering Magazine*, Aug., 1898, p. 780.

Discusses the regulations in force in London.

THE "BUILDER." Report of an Appeal by a Builder, heard at a special sitting of the Middlesex Sessions. Aug. 28th, 1898, p. 178.

The builder (Mr. Smith, of Edmonton) had been fined £5 at the Tottenham Petty Sessions, last May, for laying felt damp courses in several houses. He appealed, and this report gives the evidence of various architects, surveyors and engineers as to felt being a "durable material impervious to moisture" or not. The appeal was dismissed with costs.

Water Supply, Sewerage and Refuse Disposal.

GOUMENT, CHARLES ERNEST VERE, Assoc.M.Inst.C.E. Simla and Amballa Waterworks. *Minutes of Proceedings of Institution of Civil Engineers*, Vol. CXXXII., Part 1897-98, pp. 308 and 336.

Description of Works.

WATTS, WM., M.Inst.C.E. Notes on Drainage Areas, Storage Capacity, and Compensation Water discharged from Catchment Reservoir. *Transactions of the British Association of Waterworks Engineers*, Vol. II., 1897, p. 36.

WHITAKER, W., B.A., F.R.S. Some Middlesex Well Sections. *Transactions of British Association of Waterworks Engineers*, Vol. II., 1897, p. 76.

COTTRELL, HENRY E. P., Assoc. M. Inst. C. E. The Purification of Drinking Water. *Engineering*, August 26th, 1898, p. 253.

Continental methods of improving water supply. Qualities of a scientifically pure water. Municipal analyses in Paris, etc.

ARCHBUTT, LEONARD. Water Softening and Purification by the Archbutt-Deeley process. *Engineering*, August 19th, 1898, p. 230.

(Continued). Softening apparatus. General remarks. River Derwent water. Other applications. Cost and advantages of softening. Clarification of waste water.

EDITOR OF "BUILDER." Hampton Court and Wolsey's Leaden Pipes. *The Builder*, Aug. 20th, 1898, p. 167.

Description of leaden pipes used to convey pure water from springs at Coombe Hill to Surbiton and across the bed of the Thames 780 yards above Kingston Bridge and on through the Home Park to Hampton Court Palace. These pipes weigh about 16 lbs. to 1 foot, and are estimated to have cost £50,000 (present money). They are now being dug up by H.M. Office of Works.

DELÉPINE, SHERIDAN, M.B., B.Sc. Bacteriological Survey of Surface Water Supplies (concluded). *The Journal of State Medicine*, July, 1898, p. 290.

Already indicated.

ERMENGENA, Dr. E. VAN. Stérilisation des Eaux par l'Ozone. *La Technologie Sanitaire*, June 15th, July 1st and 15th, 1898, Nos. 22, 23 and 24, pp. 548, 570 and 598.

Experiments showing the value of the Tindal system of purifying and sterilising impure water by electrical treatment.

DAVIS, FLOYD. The Interpretation of Sanitary Water Analyses. *The Engineering Magazine*, April, 1898, p. 68.

Points out the importance of a sanitary survey, chemical analysis, microscopical and bacteriological examination, and detecting the origin of pollution.

HAZEN, ALLEN. The Purification of River Water Supplies. *The Engineering Magazine*, May, 1898, p. 249.

Description, with illustrations, of filters in England, America, and Germany.

STEWART, ALEXANDER, Assoc. M. Inst. C.E. Notes on Sewer Ventilation as applied to Water of Leith Intercepting Sewer. *The Surveyor*, July 15th, 1898, p. 88.

Polluted condition of "Water of Leith." Observations and readings of the ventilation of the sewers of Edinburgh. The system in vogue at Edinburgh.

WANNER, P. D. Specifications for Cast Iron Pipes. *Engineering Record*, Vol. XXVIII., No. 4, June 25th, 1898, p. 79.

Details of tests for cast iron water pipes.

ROBSON, O. CLAUDE, M.I.C.E. President's Address to Association of Municipal and County Engineers. *The Builder*, July 9th, 1898, pp. 34 and 35.

Sewage disposal—Ventilation of sewers—Abolition of traps upon house drains — Highways — Supervision of buildings — Electric lighting, &c.

Other papers were read at Annual Meeting upon "Tarred Macadam Roads," "Refuse Destructors," "Cable Traction," and "Intercepting Sewer for Noxious Trades Refuse."

ADENEY, W. E., D.Sc., &c. Recent Advances in the Bacterio-chemical Study of Sewage and Polluted Waters—Sewage Sludges. *The Surveyor*, Aug. 5th, 1898, p. 184.

Precipitation by manganese compounds—Peroxide of manganese—Effect on solid organic sewage matters. Is the use of manganese compounds practicable?

HERING, RUDOLPH. Bacterial Processes of Sewage Purification. *The Engineering Magazine*, Sept., 1898, p. 960.

Description, with illustrations, of the processes adopted at Exeter and Sutton.

——— Dilution Process of Sewage Disposal. *The Engineering Magazine*, July, 1898, p. 575.

Discusses the disposal of sewage by its discharge into rivers.

MOOR, C. G., F.C.S. Sewage Analysis and Standards of Purity for Effluents. *The Analyst*, Aug., 1898, p. 198.

Sufficiently indicated in title.

PARRY, W. KAYE, M.A., etc. Progress in Sewage Purification. *The Surveyor*, Sept. 9th, 1898, p. 333.

Principle of the Dortmund tank. Mr. Bailey Denton's work. The question of cost.

GLOVER, EDWARD. Street Making and Hygiene. *The Surveyor*, Sept. 16th, p. 358.

The pavements in slums, Law as to private streets. Street surface formation. Scavenging. Subsoil and surrounding drainage.

WATSON, FRANK L., Assoc.M.Inst.C.E. The Designing and Construction of Refuse Destructors. *The Surveyor*, Sept. 2nd, 1898, p. 300.

Points to be borne in mind in designing a destructor. The Edinburgh destructor. Bradford and Norwich destructors.

WEYL, N. (Berlin). L'Hygiène des rues. *La Technologie Sanitaire*, June 15th, 1898, No. 24., p. 608.

Disposals of house refuse. Cleaning and watering streets. Advantages of salt-water.

YOUNG, JOHN. Experience of Edinburgh with Refuse Destructors. *The Surveyor*, July 8th, 1898, p. 44.

Mode of collection and nature of refuse. Decline in demand by farmers. Reports of Committee of Investigation. Various forms of destructors. Table of tests. Edinburgh destructor.

Heating, Lighting, and Ventilating.

BLACKMORE, J. J. Systems and Apparatus for Heating Buildings by Steam. *The Engineering Magazine*, April, 1898, p. 28.

A very practical paper, with illustrations, based upon the systems employed in America.

——— Heating Buildings by the Warm-air System. *The Engineering Magazine*, June, 1898, p. 430.

Description, with illustrations, of the system adopted in America.

TWELVETREES, W. N. Heating and Sanitation of Public Institutions. *The Engineering Magazine*, Aug., 1898, p. 759.

Description, with illustrations, of the heating and sanitary arrangements at the Brook Hospital of the Metropolitan Asylums Board at Shooter's Hill.

HARMAN, EDWARD A. Illuminating Gas from Sewage Sludge *Engineering*, July 29th and Aug. 5th, pp. 151 and 183.

"Letters to the Editor," which contain very useful information.

STUBBS, J. PEMBERTON, Assoc. M. Inst. C. E. Acetylene Gas Generators and the Essentials of Safety in their Construction and Use. *Engineering*, July 15th and 22nd, 1898, pp. 88 and 123.

Generator tests, and results therefrom. Carbide of calcium. Dangers of acetylene. Generators. Types of apparatus. Automatic machines. Non-automatic machines. Method of testing. The Petroleum Acts.

SNOW, WALTER B. Mechanical Draft. *Engineering Record*. Vol. XXVIII., No. 8, July 23rd, 1898, p. 166.

Economical advantages of fans over chimneys.

Personal and Domestic Hygiene.

LEY, Dr. Hygiène de la Vue Chez les Ecoliers. *La Technologie Sanitaire*, No. 2, 4th year, Aug. 15th, 1898, p. 34.

Importance of suitable furniture—lighting—size of print—colour of paper—positions of scholars—sewing—as affecting eyesight.

EDITOR OF "ENGINEERING." The United States Hospital Ship "Solace." *Engineering*, Aug. 19th, 1898, p. 229.

An interesting illustrated article.

DYER, BERNARD, D.Sc. On Chicory, and Variations in its Composition. *The Analyst*, Sept., 1898, p. 226.

Recording some results of a recent investigation into the composition of the chicory at present on the market.

RICHMOND, H. DROOP. The Calculation of "added water" in Adulterated Milks. *The Analyst*, July, 1898, p. 169.

A proposal that the sum of the fat and gravity be used for the calculation of added water, instead of the solids-non-fat. The author shows that the gravity and fat is not only less affected by experimental error than the solids-non-fat, but that it is a more constant figure in genuine milks.

HILL, CHAS. A., B.A., and ABRAM, J. H., M.D. The Disinfection of the Excreta. *British Medical Journal*, April 16th, 1898, p. 1012.

Various disinfectants classified according to value as result of bacteriological tests. Urges importance of thorough mixing with excreta and allowing to stand at least half-an-hour.

NOTES ON BOOKS AND PAPERS IN TRANSACTIONS.

"Society of Engineers, Transactions 1897 and General Index, 1857 to 1897." 235 pp., 8vo. *E. & F. N. Spon*. London, 1898.

Most of the papers in this Volume are of special interest to the Sanitary Engineer, notably the President's Inaugural Address by G. Maxwell Lawford.

Notes on the proposed By-Laws of the London County Council with respect to House Drainage, by James Patten Barber.

Filter Presses for Sewage Sludge, by James Croll.

The Pollution of Water and its correction, by R. E. Middleton.

"British Association for the Advancement of Science. Report of the Sixty-seventh Meeting held at Toronto in August, 1897." 1016 pp. *John Murray.* London, 1898.

Among the large number of Scientific papers in this Volume there are many of Sanitary interest. Mention, may however specially be made of the "Report on the elucidation of the life conditions of the Oyster under normal and abnormal environment, including the effect of Sewage matters and Pathogenic organisms." "Report on the Mental and Physical deviations from the normal among children in Public Elementary and other Schools."

The action of Glycerine on the Tubercle Bacillus, by S. Monkton Copeman, M.A., M.D., and F. R. Blaxall, M.D.

"The Institution of Civil Engineers, Minutes of Proceedings of." Vol. CXXXI., 1897-98. Part I.

The following papers of a Sanitary interest will be found among the abstracts of papers in Scientific Transactions and Periodicals:—

The removal of internal corrosion from the mains of the Kendal Waterworks, by T. N. Ritson (Industries and Iron, Vol. XXIII., 1897, p. 106).

The conveyance of Bacteria by underground Water, by Prof. E. Pfuhl (Zeitschrift für Hygiene, 1897, p. 549).

Destruction of Town Refuse at Berlin, by Town Councillor Bohm and Government Architect Grohn (Zeitschrift für Transportwesen und Strassenbau, 1897, p. 500).

The Jointing of Stoneware Pipes and the employment of Asphalt Joints, by A. Unna (Gesundheits-Ingenieur, 1897, p. 260).

Automatic Drain Trap (Zeitschrift für Transportwesen und Strassenbau, 1897, p. 433).

The Sewers of Rome, by Ronna (Bulletin de la Société d'Encouragement pour l'Industrie Nationale, October, 1897, p. 1277).

A modified form of Pettersson-Palmqvists's Carbonic-acid Gas Apparatus for Ventilation Experiments, by Gerda Troilä-Petters (Zeitschrift für Hygiene, Vol. XXVI., Part I., p. 57).

Ventilating the United States Senate Chamber (The Engineering Record, New York, 1897, pp. 431 and 454).

The Pollution of Air in Gas-works Buildings, by H. Drehschmidt (Journal für Gasbeleuchtung, 1897, p. 517).

"The Institution of Civil Engineers, Minutes of Proceedings." Vol. CXXXII. Part II. 1897-98.

Among "Abstracts of Papers in Scientific Transactions and Periodicals" are—

Lowering of ground Water Level by means of Tube-wells, by Bredtschneider (Centralblatt der Bauverwaltung, 1890, pp. 73 and 88).

A Water-supply and system of Filtration, by Alfons Halkowich (Mittheilungen über Gegenstände des Artillerie- und Genie-Wesens, 1898, p. 31).

The Results obtained by Subsoil Drainage for the Supply of the Amsterdam Water-works, J. van Hasselt (Tijdschrift van het koninklijk Institunt van Ingenieurs, 1895-96, p. 40).

The Water-supply from the Downs near Schevening for the Hague Water-works, by Fb. Stang (Tijdschrift van het koninklijk Institunt van Ingenieurs, 1895-96, p. 57).

A Fresh-water Conduit across the Y at Amsterdam, by T. M. K. Pennink (Tijdschrift van het koninklijk Institunt van Ingenieurs, 1896-97, p. 113).

Coolgardie Gold Fields Water-supply (The Engineer, 21st January, 1898, p. 57).

Clarification of the Cologne Sewage Water, by Dr. Karl Fraenkel (Gesundheits-Ingenieur, 15th November, 1897, p. 353).

Dumping Ground for Town Ashes and Rubbish at Giessen, by Dr. K. Kratz (Zeitschrift für Hygiene, Vol. XXVI., 1898, p. 243.

Vol. CXXXIII. Part III. 1897-98.

Among "Abstracts of Papers in Scientific Transactions and Periodicals" are—

The Purification of the Seine, by G. Bechmann (Bulletin de la Société d'Encouragement pour l'Industrie Nationale, 1898, p. 120).

Floods: their Causes, Effects, and Prevention, by A. de Beil (Annales de l'Association des Ingénieurs sortis des Ecoles spéciales de Gand, 1898, p. 5).

The Drainage of Rain-Storms, by Tilschkert (Mittheilungen über Gegenstände des Artillerie-und Genie-Wesens, 1898, p. 201).

Rainfall in relation to Sewers, by W. C. Parmley (Journal of the Association of Engineering Societies, 1898, p. 204).

Rapid Double Filtration and Aëration of Sewage at Reading, Pa. (Engineering News, New York, 27th January, 1898).

The Liernur System of Sewerage in Amsterdam (Glasers Annalen für Gewerbe und Bauwesen, 1st March, 1898, p. 93).

Apparatus for Continuous and Automatic Disinfection, by H. Köhler (Gesundheits-Ingenieur, 1898, p. 53).

The Sterilisation of Liquids by Filtration, by J. Hausser (Comptes Rendus de l'Académie des Sciences Paris, Vol. CXXXVI., 1898, p. 844).

Formic Aldehyde as a Disinfectant, by Kurt Walter (Zeitschrift für Hygiene, Vol. XXVI., 1897, p. 454).

Formic Aldehyde and the work of Public Disinfection, by F. Abba and A. Rondelli (Zeitschrift für Hygiene, Vol. XXVII., 1898, p. 49).

Antiseptic Properties of Phenolalcohols, by George Cohn (Zeitschrift für Hygiene, Vol. XXVI., 1897, p. 377).

Estimation of Carbonic Oxide in Atmospheric Air, by Maurice Niclous (Comptes Rendus de l'Académie des Sciences Paris, Vol. CXXVI., 1898, p. 746).

A Method of Estimating Carbonic Oxide diluted with Air, by Armand Gautier (Comptes Rendus de l'Académie des Sciences Paris, Vol. CXXVI., 1898, p. 931).

L'Assainissement de la Seine, conférence faite le 16 November, 1897, par M. G. Bechmann, Ingenieur en chef des Ponts-et-chaussées. 32 pp., 4to. Extrait du Bulletin de l'Société d'Encouragement pour l'Industrie nationale, Fevrier. Paris, 1898.

This paper, which was addressed to the Société d'Encouragement, details the history of the drainage of Paris, and then describes the sewerage works and the methods and machinery adopted in their construction. It is illustrated with maps and plans and views of the various works in progress of construction.

MEETINGS HELD JULY TO SEPTEMBER, 1898.

CONGRESS.

The Seventeenth Congress and Exhibition of the Institute was held at Birmingham from September 27th to October 1st by invitation of the Right Honourable the Lord Mayor and City Council.

Very suitable accommodation was provided for the meetings of the Congress in the Town Hall, Mason University College, and the Birmingham and Midland Institute, and excellent arrangements were made for the reception and convenience of members. The Exhibition was held in Bingley Hall, so well known for Exhibitions and Meetings of this kind.

The Congress was received by the Right Honourable the Lord Mayor (Councillor C. G. Beale), and his speech of welcome was responded to by Sir Douglas Galton, K.C.B., F.R.S., Vice-President and Chairman of Council, on behalf of the Institute; Major Lamorock Flower, Chairman of the Congress Committee, on behalf of the Congress; and Sir Joseph Ewart, M.D., J.P., on behalf of the Delegates from Local Authorities.

A Public Luncheon was held in the Grand Hotel, at which the Right Honourable the Lord Mayor presided, and the following toasts were proposed:—

The Queen, by the Chairman.

The Sanitary Institute, by the Chairman.

Responded to by Sir Douglas Galton, K.C.B., D.C.L., LL.D., F.R.S

The Lord Mayor and Corporation, by Sir Joseph Fayrer, Bart K.C.S.I., M.D., LL.D., Q.H.P., F.R.S.

Responded to by Alderman W. Cook, J.P.

The first General Meeting was held on September 27th Sir Joseph Fayrer, Bart., K.C.S.I., M.D., LL.D., Q.H.P., F.R.S., was installed as President of the Congress by Sir Douglas Galton, K.C.B., F.R.S., Vice-President and Chairman of Council, and delivered his Inaugural Address.

The Right Hon. the Lord Mayor formally opened the Exhibition.

The business of the Congress was divided into three Sections, and five Special Conferences were held. Particulars of these are given in the programme of the Congress in Part II. of the

Journal. During the Congress 67 addresses and papers were read, and the business was divided into 14 meetings. The Presidents' Addresses are published in the present number of the Journal. The papers read in the Sectional Meetings with the discussions upon them will be published in Part IV. of the present volume, and an abstract of the proceedings of the Conferences will be given in Part I. of Vol. XX.

The Health Committee entertained the members at a Garden Party at the Botanical Gardens, Edgbaston.

During the meeting excursions were made to Dudley Castle and Wrens Nest, Limestone Caverns, Whitacre Pumping Station and Shustoke Reservoirs, Saltley Sewage Farm, Croft Granite, Brick, and Concrete Works, Stratford-on-Avon, Warwick Castle, and Malvern, at which places the members were most hospitably entertained by Right Hon. Earl Beauchamp, Right Hon. Earl of Dudley, His Worship the Mayor of Warwick, Alderman Lawley Parker, Chairman of Water Committee, Alderman Baker, Chairman Tame and Rea Drainage Board, and others.

Visits were also arranged to a large number of manufactories in Birmingham, including Gun Making, Brass Foundry, Cycle Making, Spinning, Glass Blowing, Pen Making, and other Industries.

The Gas Works, Refuse Depôt, Fire Station, Water Department, Meat Market, and other Municipal undertakings were visited.

The numbers attending the Congress were as follows:—Delegates, 880; Members and Associates of the Institute, 549; Associates of the Congress, 400; Complimentary and Press, 150—making a total attendance of 1979.

Delegates were appointed by 431 Sanitary Authorities and learned Institutions.

Examinations.

At an Examination in Practical Sanitary Science, held in Cardiff on July 8th and 9th, 1898, two candidates presented themselves, to whom Certificates were granted:—

1898, July 9. Jarvis, Joseph Edward, 14, Lipson Vale, Plymouth.

1898, July 9. Tamlyn, William John, The Parade, Minehead, Somerset.

At an Examination for Inspectors of Nuisances, held in Cardiff on July 8th and 9th, 1898, 40 Candidates presented themselves.

The following 30 Candidates were certified, as regards their Sanitary Knowledge, competent to discharge the duties of Inspectors of Nuisances:—

1898, July 9. ASQUITH, ARTHUR, 7, Bailey Street, Ton Pentre, R.S.O., Glamorgan.
1898, July 9. BISHOP, ERNEST GEORGE, 24, Gibbon Street, Plymouth.
1898, July 9. BROMHAM, WILLIAM JOHN, 30, Vivian Street, Swansea.
1898, July 9. BURNARD, ISAIAH, 4, Littleton Place, Stoke, Devonport.
1898, July 9. DAVIES, THOMAS JOHN, 42, Gwendoline Street, Treherbert.
1898, July 9. EVANS, THOMAS WILLIAM, Church Cottage, Bailey Street, Ton Pentre, R.S.O., Glamorgan.
1898, July 9. FISHER, WILLIAM, Chulmleigh House, Pontcanna Road, Cardiff.
1898, July 9. HOPKINS, WILLIAM JOHN, 43, Regent Street, Barry.
1898, July 9. JAMES, WILLIAM OWEN, Hong Kong House, Melyncrythan, Neath.
1898, July 9. JEFFERY, SAMUEL, 46, Carlisle Street, Splotlands, Cardiff.
1898, July 9. JENKINS, EBENEZER, Yarmouth House, Havelock Street, Cardiff.
1898, July 9. JOHN, LEVI, 103, North Road, Porth.
1898, July 9. JONES, JOHN W., Belgrave Tavern, Cwmbwrla, Swansea.
1898, July 9. JONES, RHYS WILLIAM, Morfa Uchaf Penycae, Ystradgwnlais.
1898, July 9. KINCH, MAURICE WHINLEY, 3, Walnut Villas, Cockington, Torquay.
1898, July 9. KIRKBY, REGINALD GUY, 1, Cairo St., Sunderland.
1898, July 9. LEWIS, DAVID, 14, Alexandria Road, Pontycymmer, Garw Valley.
1898, July 9. MORGAN, WILLIAM, Crown Terrace, Llantrisant.
1898, July 9. ORIEL, THOMAS JOHN, 5, Pell Street, Swansea.
1898, July 9. PERKINS, JONAH REES, 16, Rhyddings Park Road, Swansea.
1898, July 9. REES, FREDERICK SAMUEL, 20, Gileston Road, Cathedral Road, Cardiff.
1898, July 9. SMITH, HERBERT WILLIAM SPENCER, 136, Malpas Road, Newport, Mon.
1898, July 9. STONE, JAMES ARTHUR, 38, Church Road, Weston-super-Mare.
1898, July 9. *L*SULLIVAN, Miss FINOLA, 15, Milton Chambers, Cheyne Walk, S.W.

1898, July 9. TARRANT, WILLIAM HENRY, 50, Somerset Street, Abertillery.
1898, July 9. THOMAS, DAVID, Rosslyn Cottage, Ferndale.
1898, July 9. THOMAS, JAMES JASON, 14, North Street, Ferndale.
1898, July 9. THOMAS, JOHN TOWY, Brynawen, 247, High Street, Porth, Rhondda.
1898, July 9. THOMAS, JOHN WILLIAM, 4, Marian Street, Clydach Vale.
1898, July 9. WILLIAMS, WILLIAM, 74, George Street, Pontnewynydd, Pontypool.

Examination Questions.

Practical Sanitary Science.—Cardiff, July 8th and 9th, 1898.

PAPER I.

1. Define motion, velocity, force, matter, and pressure.

2. What is the action of waters of varying composition on lead pipes? What is the best method of dealing with the distribution of water known to take up lead? What quantity of lead in water is considered objectionable? and how would you ascertain its presence?

3. Define the expression "degrees of hardness" as applied to potable waters. How would you estimate the hardness of water?

4. What considerations would govern your selection of a site for an impounding reservoir in a mountainous district? How would you proceed to ascertain the quantity of water available for supply?

PAPER II.

5. What are the constituents of Portland cement and from what does it derive its hydraulicity? What is the setting of the cement due to? How would you proceed to test a sample of cement?

6. Under what conditions is carbon-monoxide gas sometimes found in the air of inhabited places? What is known about the physiological effects of this gas on human beings?

7. What process would you recommend for dealing with the sewage from an ordinary town previous to its discharge into a brook, the flow of which is twenty times that of the dry weather flow of the sewage?

8. Give the substance of the London County Council Bye-Laws in reference to the construction of new water-closets. How far do the same bye-laws apply to the alteration of existing water-closets?

The Candidates were examined vivâ voce *on the 9th.*

Inspector of Nuisances.—Cardiff, July 8th and 9th, 1898.

1. Define a "Canal Boat." State when such boats may be used as dwellings, and give the usual regulations applicable to them.

2. What powers have sanitary authorities for regulating dairies and cowsheds? State briefly the provisions of the regulations usually enforced.

3. What head of water is sufficient for testing stoneware socket-jointed pipes, and what time should elapse between making the joint (Portland cement) and applying the test.

4. Give detailed directions for disinfecting the surfaces of a room with an area of 2,500 cubic feet by means of—

(*a*) A liquid disinfectant;
(*b*) A gaseous disinfectant.

5. Describe the method you would use, and the instruments you would employ, if asked to make a complete and detailed report upon an ordinary house as to

(*a*) The ventilation;
(*b*) The drainage;
(*c*) The sanitary appliances;
(*d*) The general sanitary condition.

6. What are the nuisances that are likely to arise from the carrying on of the business of a fat melter? How may they be obviated?

7. State the relative advantages and disadvantages of a combined and separate system of dealing with the sewage and rainfall of an urban district.

8. What statutory provisions relating to an adequate pure supply of water to premises are in force—

(*a*) Under the Public Health Act, 1875?
(*b*) Under the Public Health (London) Act, 1891?

The Candidates were examined vivâ voce *on the 9th.*

At an Examination in Practical Sanitary Science, held at Liverpool, on July 29th and 30th, 1898, 5 Candidates presented themselves.

The following 3 Candidates were granted Certificates in Practical Sanitary Science:—

1898, July 30. Bellamy, Herbert Ernest Municipal Buildings, Truro.
1898, July 30. Graham, Thomas, 20, Alfred Road, Birkenhead.
1898, July 30. Summers, Thomas, M.INST.C.E., 32, Craigmillar Park, Edinburgh.

At an Examination for Inspectors of Nuisances, held at Liverpool, on July 29th and 30th, 1898, 64 Candidates presented themselves.

The following 37 Candidates were certified, as regards their Sanitary Knowledge, competent to discharge the duties of Inspectors of Nuisances:—

1898, July 30. Allan, John, 78, Holmscroft Street, Greenock.
1898, July 30. Atkinson, Fred, 7, Malton St., Coppice, Oldham.

1898, July 30. BARE, FREDERICK THOMAS, 12, Pelham Terrace, Pelham Road, Gravesend.
1898, July 30. BICKFORD, WALTER FELTHOUSE, 10, Alfred Street, Plymouth.
1898, July 30. BROOKLEHURST, JOSEPHUS HIGGINBOTTOM, 117, Old Land, Hollinwood, Chadderton, Oldham.
1898, July 30. CHEETHAM, AUGUSTUS ERNEST, 70, Church Road, Urmston, Manchester.
1898, July 30. CLIFFE, ALFRED, 15, Bremner Street, Liverpool.
1898, July 30. *L* COPPOCK, Miss EMMA, 49, Poplar Grove, Urmston, near Manchester.
1898, July 30. CORBRIDGE, HENRY, 26, Dacy Road, Everton, Liverpool.
1898, July 30. CROSSLAND, JAMES, South Langrigge, Bowness-on-Windermere.
1898, July 30. CROXFORD, ALFRED EDWARD, 423, Mill St., Liverpool.
1898, July 30. DAFT, JOHN JAMES, 9, Clyde Street, Wilford, Nottingham.
1898, July 30. FLOOD, WALTER THOMAS, 9, Catherine Street, Warrington.
1898, July 30. FRANCE, CHARLES HAROLD, 15, New Market Street, Wigan.
1898, July 30. GARSIDE, MALCOLM, Ellesmere Villas, Stockton Heath, Warrington.
1898, July 30. GLENN, THOMAS, 5, Joseph Street, Daubhill, Bolton, Lanc.
1898, July 30. GREEN, JOHN THOMAS, 12, Thorpe Road, Walsall.
1898, July 30. HARRISON, WILLIAM, 29, Albany Road, Kensington, Liverpool.
1898, July 30. HERMANN, JOSEPH, 11, East Hill, Dartford, Kent.
1898, July 30. HOBDAY, CECIL FRANK, West Norwood Estate Offices, S.E.
1898, July 30. JACKSON, WALTER JOSEPH, 65, Northumberland Terrace, Everton, Liverpool.
1898, July 30. JACKSON, WILLIAM HENRY, 37, Buckingham Road, Aintree, Liverpool.
1898, July 30. LANGLEY, RICHARD JOHNSON, Jun., Bolton-le-Sands.
1898, July 30. LEIGH, ARTHUR GRAHAM, Chorcliff House, Chorley, Lancs.
1898, July 30. MARSHALL, CHARLES FREDERICK, 48, Arthur Street, Liverpool.
1898, July 30. MARSHALL, JAMES, 16, Stevenson St., Little Hulton, near Bolton.
1898, July 30. MOORE, JOHN, 10, Duke St., South Shore, Blackpool.
1898, July 30. PARTINGTON, SAMUEL, 148, Chapel Rd., Hollinwood.
1898, July 30. ROSSINGTON, JOHN FREDERICK, 337, London Road, Sheffield.
1898, July 30. SHARPS, THOMAS, 60, Nansen Street, Seedley, Manchester.

1898, July 30. SILCOX, HENRY GEORGE WILLIAM, 5, Fountain Buildings, Bath.
1898, July 30. SMITH, ARTHUR, 12, Jubilee Grove, Seacombe.
1898, July 30. WALKER, JOHN, Fellside School, Kendal.
1898, July 30. WILLIAMS, FREDERICK HORACE, High Town, Crewe, Cheshire.
1898, July 30. WILLIAMS, OWEN O., Rhyd Llanfrothen, Penrhyndendraeth.
1898, July 30. WINTER, WILLIAM JOHN, 24, New Bird Street, Liverpool.
1898, July 30. WINTERBOTTOM, GEORGE, 57, Cobden Street, Waterhead, Oldham.

Examination Questions.

Practical Sanitary Science.—Liverpool, July 29th & 30th, 1898.

PAPER I.

1. On what does the velocity of a liquid issuing from an orifice depend? What is the effect of bends and branches in pipes upon the flow of the liquid?

2. Define the terms "Porosity," "Capillarity," "Absorptivity," and "Permeability."

3. State in detail the method adopted by Public Water Companies for the purification of water from springs, rivers, &c. Explain fully the action of such filter beds, and how the water should be stored after filtration and before delivery.

4. Describe the method of coating cast-iron pipes for water supply with Dr. Angus Smith's composition. Give the proportions of materials used.

PAPER II.

5. What do you understand by the terms "Wetted perimeter," and "Hydraulic mean depth?" What would be the flow in a rectangular aqueduct of brickwork, 10 feet wide, flowing 5 feet deep, with a fall of 9 inches per mile?

6. State what you know as to the proper construction of a furnace with boiler for steam raising, which has to consume the smoke produced from the combustible used in it. What are the different kinds of fuel used in steam boilers, and what are the main characteristics of each?

7. Describe the steps you would take, and the instruments you would use, to test the amount and regularity of the fall in a main drain.

8. Describe in detail the procedure for discovering and dealing with unsound food.

The Candidates were examined vivâ voce *on the* 30th.

Inspector of Nuisances.—Liverpool, July 29th and 30th, 1898.

1. What is the best position for an underground soft water cistern in a country house? How should it be constructed? Show by sketches how you would deal with the overflow therefrom.

2. Describe a good form of slop sink, stating the sizes of flush pipe and outlet, and the method of trapping the same. Under what conditions may the waste from a slop sink be connected to a vertical soil-pipe?

3. Mention the various kinds of joints made in connecting lengths of lead soil pipe. State which variety you prefer, with the reasons for your selection.

4. Describe the conditions under which privies should be allowed, and give a sketch plan of one you would recommend.

5. State the statute law providing for the abatement of smoke nuisance.

6. A bedroom of about 3,000 cubic feet of area has been occupied by a patient suffering from small-pox. Describe in detail how the room and its contents may be efficiently disinfected.

7. Describe briefly the construction of three kinds of roof covering, and illustrate by sketches. State the advantages and disadvantages of each from a sanitary point of view.

8. What powers have sanitary authorities, and under what Acts, for dealing with milk alleged to be unwholesome or adulterated?

The Candidates were examined vivâ voce *on the 30th.*

FORTHCOMING MEETINGS.

Calendar, October to December, 1898.

As far as at present arranged.

Council Meetings are held Monthly on the Second Wednesday [of] each Month at 5 p.m., except August and September.

Special Purposes Committee .	. Third Monday at 5 p.m.
Finance Committee . . .	. Second Wednesday at 4.30 p.m.
Exhibition Committee . . .	. First Tuesday at 5 p.m.
Congress and Editing Committee	. Second Monday at 5.15 p.m.
Museum and Library Committee	. Fourth Monday at 5 p.m.
Parliamentary Committee .	. As occasion requires.
Rivers Pollution Committee .	. As occasion requires.

OCTOBER.

17 M. Introductory Lecture (Admission Free). Sir Douglas Galton, K.C.B., D.C.L., LL.D., F.R.S.

19 W. Inspection and Demonstration of Disinfecting Apparatus and Model Steam Laundry, at St. John's Wharf, Fulham, at 3.30 p.m., conducted by W. G. Lacy.

19 W. Lecture to Sanitary Officers at 8 p.m. Sanitary Laws and Regulations Governing the Metropolis, by Louis Parkes, M.D., D.P.H., Lecturer on Public Health, St. George's Hospital, Medical Officer of Health, Chelsea.

21 F. Lecture to Sanitary Officers at 8 p.m. Sanitary Law—English, Scotch, and Irish; General Enactments Public Health Act, 1875; Model By-Laws, &c., by Herbert Manley, M.A. (CANTAB), M.B., D.P.H., Medical Officer of Health, West Bromwich.

22 S. Inspection and Demonstration at the Wimbledon Sewage Works, at 3 p.m., conducted by C. H. Cooper, ASSOC.M.INST.C.E., Engineer and Surveyor, Wimbledon Urban District Council.

24 M. Lecture to Sanitary Officers at 8 p.m. The Law Relating to the Supervision of Food Supply, by W. A. Bond, M.A., M.D., D.P.H., Medical Officer of Health, Holborn, and St. Olave's, Southwark.

26 W. Inspection and Demonstration in the Parish of St. George's, Hanover Square, at 2 p.m. (number limited), conducted by Albert Taylor, Chief Sanitary Inspector.

26 W. Lecture to Sanitary Officers at 8 p.m. Trade Nuisances, by Prof. A. Bostock Hill, M.D., D.P.H. (CAMB.), F.I.C., Queen's Professor of Hygiene and Public Health, Mason's University College, Birmingham, Medical Officer of Health, Sutton-Coldfield, &c.

28 F. Lecture to Sanitary Officers at 8 p.m. Objects and Methods of Inspection, Nuisances, &c., by J. F. J. Sykes, D.SC., M.D., Lecturer on Public Health, Guy's Hospital, Med. Officer of Health, St. Pancras.

29 S. Inspection and Demonstration at Express Dairy Company's Farm, College Farm, Finchley, at 3 p.m.

31 M. Lecture to Sanitary Officers at 8 p.m. Water Supply, Drinking Water, Pollution of Water, by Prof. W. H. Corfield, M.A., M.D.(OXON.), F.R.C.P., Professor of Hygiene and Public Health, University College, London, Medical Officer of Health, St. George's, Hanover Square.

NOVEMBER.

2 W. Inspection and Demonstration at Disinfection Station, Chelsea, at 3 p.m., conducted by Dr. Louis Parkes.

2 W. Lecture to Sanitary Officers at 8 p.m. Diseases of Animals in relation to Meat Supply; Characteristics of Vegetables, Fish, &c., unfit for food, by Alfred Hill, M.D., F.R.S.E., F.I.C., Medical Officer of Health, Birmingham.

4 F. Lecture to Sanitary Officers at 8 p.m. Infectious Diseases and Methods of Disinfection, by Henry R. Kenwood, M.B., D.P.H., F.C.S., Medical Officer of Health, Stoke Newington.

5 S. Inspection and Demonstration at the Southwark and Vauxhall Water Works, Hampton, at 3 p.m.

7 M. Lecture to Sanitary Officers at 8 p.m. Principles of Calculating Areas, Cubic Space, &c.; Interpretation of Plans and Sections to Scale, by A. S. E. Ackermann, ASSOC.M.INST.C.E., late of Central Technical College, South Kensington.

9 W. Inspection and Demonstration at East London Soap Works, Bow, E., at 3 p.m.

9 W. Lecture to Sanitary Officers at 8 p.m. Ventilation, Warming, and Lighting, by Joseph Priestley, B.A., M.D., M.R.C.S., D.P.H. (CAMB.), Medical Officer of Health, Lambeth.

11 F. }
12 S. } Examinations in Practical Sanitary Science and for Inspectors of Nuisances, Newcastle-upon-Tyne.

11 F. Lecture to Sanitary Officers at 8 p.m. Sanitary Building Construction, by Prof. T. Roger Smith, F.R.I.B.A., Professor of Architecture, University College, London, District Surveyor, West Wandsworth.

12 S. Inspection and Demonstration at Richmond Main Drainage Works, Mortlake, at 3 p.m., conducted by Wm. Fairley, ASSOC.M.INST.C.E.

14 M. Lecture to Sanitary Officers at 8 p.m. Sanitary Appliances, by G. Reid, M.D., D.P.H., Medical Officer of Health, Staffordshire County Council.

16 W. Inspection and Demonstration in the Parish of St. George's, Hanover Square, at 2 p.m. (number limited), conducted by Albert Taylor, Chief Sanitary Inspector.

16 W. Lecture to Sanitary Officers at 8 p.m. Details of Plumbers' Work, by J. Wright Clarke.

18 F. Lecture to Sanitary Officers at 8 p.m. House Drainage, by W. C. Tyndale, M.INST.C.E.

19 S. Inspection and Demonstration at Harrison & Barber's Knacker Yard, Winthrop Street, Whitechapel, at 3 p.m.

21 M. Inspection and Demonstration at the Metropolitan Cattle Market, York Road, N., at 3 p.m.

21 M. Demonstration of Diseased Meat in the Parkes Museum, at 8 p.m., by W. A. Bond, M.A., M.D., D.P.H., Medical Officer of Health, Holborn, and St. Olave's, Southwark.

23 W. Inspection and Demonstration at L.C.C. Municipal Lodging House, Parker Street, Drury Lane, at 3 p.m., conducted by Mr. Frank Ruddle, of the Estates and Valuation Department, L.C.C.

23 M. Lecture to Sanitary Officers at 8 p.m. Scavenging. Disposal of House Refuse, by Charles Jones, M.INST.C.E., Engineer and Surveyor, Ealing Urban District Council.

25 F. Lecture to Sanitary Officers at 8 p.m. Sewerage and Sewage Disposal, by Prof. Henry Robinson, M.INST.C.E.

26 S. Inspection and Demonstration at the Sewage and Destructor Works, Ealing, at 2.15 p.m., conducted by Charles Jones, M.INST.C.E., Engineer and Surveyor, Ealing Urban District Council.

28 M. Demonstration of Book-keeping as carried out in a Sanitary Inspector's Office, in the Parkes Museum at 8 p.m., by Albert Taylor, Chief Sanitary Inspector, St. George's, Hanover Square.

DECEMBER.

2 F. }
3 S. } Examinations in Practical Sanitary Science and for Inspectors of Nuisances, London.

14 W. **Sessional Meeting at 8 p.m.** Paper by Edward F. Willoughby, M.D. Lond., D.P.H., Camb., on "Some Prevalent Fallacies in Vital Statistics."

16 F. }
17 S. } Examinations in Practical Sanitary Science and for Inspectors of Nuisances, Manchester.

MEMBERS AND ASSOCIATES ELECTED.

From July to September, 1898, inclusive.

MEMBERS.

* Passed Examination in Practical Sanitary Science.
‡ Passed Examination as Inspector of Nuisances.

Reg. No	Date of Election.	
1205	1898. July.	*Ackermann, A. S. E., assoc.m.inst.c.e., 53, *Victoria Street, S.W.*
1206	1898. July.	*Bates, Henry, 100, *Bunhill Row, E.C.*
1207	1898. July.	‡Fisher, Robert, cert.assoc.m.&c.e., 55, *Calvert Road, Greenwich, S.E.*
1208	1898. July.	*Henley, William Cumming, *Duke St., Dartmouth.*
1209	1898. July.	*Hipkin, John, *The Manor House, Bedhampton, Havant.*
1210	1898. July.	Lake, William Wellington, d.p.h.cantab., m.o.h., *Topcroft, Guildford.*
1211	1898. July.	*Oliver, Gilbert T. L., assoc.m.inst.c.e., *Granton Lodge, Goodrich-on-Wye, near Ross.*
1212	1898. July.	Parker, John, assoc.m.inst.c.e., f.s.i., *City Engineer, Hereford.*
1213	1898. July.	‡Sidwell, Henry Thomas, *Herne, Canterbury.*

ASSOCIATES.

‡ Passed Examination as Inspector of Nuisances.

1761	1898. July.	‡Barker, William, 7, *Gray Road, Colchester.*
1760	1898. July.	‡Bates, William John, 101, *Sussex Rd., Holloway, N.*
1762	1898. July.	‡Best, George, 16, *Alfred Hill, Kingsdown, Bristol.*
1763	1898. July.	‡Brown, Herbert E., 80, *Grenard Road, Peckham, S.E.*
1764	1898. July.	‡Faragher, Edward Herbert, 7, *Myrtle Street, Douglas, Isle of Man.*
1765	1898. July.	‡Gedge, Edwin Dowsing, 69, *Marmion Road, Lavender Hill, S.W.*
1766	1898. July.	‡Gowen, William Herbert Stevens, 42, *Roundstone Street, Trowbridge.*
1767	1898. July.	‡Griggs, William J., 16, *Alma Square, St. John's Wood, N.W.*
1768	1898. July.	‡Gwillim, Frank Archer, *Cwm Dulas, Pontrilas.*
1769	1898. July.	‡Hawke, William John, 11, *Truro Road, St. Austell.*
1770	1898. July.	‡Hull, Thomas William, 1, *Southmoor Road, Oxford.*
1771	1898. July.	‡Jones, Isaac Richard, 18, *Lucretia Road, Kennington, S.E.*
1772	1898. July.	‡Jones, William David, *Town House, Cape Town, S. Africa.*

Reg. No.	Date of Election.	
1773	1898. July.	‡Jones, W. P., *Cymmer Glynconwy, Glam.*
1774	1898. July.	‡Lester, Arthur James, 5, *Perrymead Street, Fulham, S.W.*
1775	1898. July.	‡Luke, Percival William, 12, *Percy Road, Queen's Road, Gosport.*
1776	1898. July.	‡Malone, Miss Annie, 4, *Brunswick Square, W.C.*
1777	1898. July.	‡Markham, Sidney Septimus, 67, *Springdale Road, Stoke Newington, N.*
1778	1898. July.	‡Maynard, Miss Edith Louisa, *Wolsey House, Harrow.*
1779	1898. July.	‡Maynard, S. J., 19, *Lisson Residences, Lisson Street, N.W.*
1780	1898. July.	‡Potter, Alfred George, 101, *Wakehurst Road, Wandsworth Common, S.W.*
1781	1898. July.	‡Pratt, Joseph John, *Hillingdon, near Uxbridge.*
1782	1898. July.	‡Quelch, Arthur Stephen, 136, *Walton Street, Oxford.*
1783	1898. July.	‡Reynolds, John Howells, *Wellington, Salop.*
1784	1898. July.	‡Taviner, H., 16, *Denny Road, Edmonton.*
1785	1898. July.	‡Thomas, Charles Russell, 142B, *High Street, Lewisham, S.E.*
1786	1898. July.	‡Toogood, Henry John, *Town Hall, Spa Road, Bermondsey.*
1787	1898. July.	‡Toogood, Henry Stephen, 56, *Buxton Road, Thornton Heath, Croydon.*
1788	1898. July.	‡Tribe, Thomas, *Church Rd., Farncombe, Godalming.*
1790	1898. July.	‡Walker, George Simpson, 10, *Pembroke Square, Kensington,* W.
1791	1898. July.	‡Wells, John, 40, *Jessica Road, Wandsworth Common, West Side, S.W.*
1789	1898. July.	‡White, Frank, 16, *Wellington Place, Northampton.*
1792	1898. July.	‡Wilkinson, Michael Hutchinson, 5, *Flavia Terrace, South Shields.*
1793	1898. July.	‡Williams, Thos. Wm., 32, *Barking Road, West Ham, E.*
1794	1898. July.	‡Worrow, Isaac, 156, *High Street, Shadwell, E.*

CONTRIBUTIONS AND ADDITIONS TO LIBRARY

JUNE TO SEPTEMBER, 1898.

*** *For publication of Societies and Institutions, &c., see under "Academies."*

ACADEMIES (AUSTRALIAN).

New South Wales. *Royal Society of.* Journal and Proceedings. 626 pp., 8vo. Sydney, 1898. *The Society.*

ACADEMIES (BRITISH).

London. *British Association of Waterworks Engineers.* Transactions, Vols. I. and II., 1896 and 1897. 224 pp. and 276 pp. 8vo. London, 1897 and 1898. *The Association.*

——— *Royal Statistical Society.* Journal of, Vol. LXI., Part I. 209 pp., 8vo. London, 1898. *The Society.*

——— *The Institution of Civil Engineers.* Minutes of Proceedings, with other selected and abstracted papers. Vol. CXXII., 1897-98, Part II., 507 pp. Vol. CXXIII., 1897-98, Part III., 523 pp., 8vo. London, 1898.

——— Report of Committee on the Thermal Efficiency of Steam Engines. 37 pp. *The Institution.*

——— *Royal Institution of Great Britain.* Proceedings. Vol. XV., Part II., No. 91. 271 pp., 8vo. London, 1898. *The Institution.*

Newcastle-upon-Tyne. *North of England Institute of Mining and Mechanical Engineers.* Transactions, Vol. XLVII., Parts IV. and V. 8vo. Newcastle-on-Tyne, 1898. *The Institution.*

ACADEMIES (CANADIAN).

Manitoba. *Historical and Scientific Society of.* Annual Report for 1897, and other pamphlets. 22 pp., 8vo. Winnipeg, 1898. *The Society.*

Toronto. *Canadian Institute.* Transactions, No. 10, May, 1898. Vol. V., Part II.; 201 p. Proceedings, New Series, Vol. I., Parts IV. and V., May, 1898; pp. 118. Supplement to No. 9, Vol. V., Part I. 8vo. Toronto, 1898. *The Institute.*

ACADEMIES (CONTINENTAL).

Amsterdam. *Royal Academy of Sciences.* Verslagen van de Gewone Vergaderingen der Wis-en Natuurkundige Afdeeling, van 29 Mei, 1897, tot 23 April, 1898. Deel VI., 584 pp., 4to. Amsterdam, 1898. Deel VI., No. 1. 34 pp., 4to. Amsterdam, 1897. *The Academy.*

Australian Health Society. Twenty-second Annual Report, 1896-7. 16 pp., 8vo. Lecture on Infant Feeding: the use and abuse of artificial foods. 15 pp., 8vo. Melbourne, 1897. *The Society.*

Bechmann, *M. G.* L'Assainissement de la Seine. Conférence faite le 16 Novembre, 1897. 32 pp., 4to. Paris, 1898. *The Author.*

Board of Agriculture. Agricultural Returns for Great Britain, showing the acreage and produce of crops, prices of corn and number of live stock; with Agricultural Statistics for the United Kingdom, British Possessions, and foreign countries, 1897. 263 pp., 8vo. London, 1898. *The Board.*

Bombay. Thirty-Fourth Annual Report of the Sanitary Commissioner for the Government of Bombay, 1897, with Appendices. 154 pp. Bombay, 1898. *Surg.-Maj. J. W. Clarkson.*

British Columbia, Province of. Annual Report of the Minister of Mines for the year ending 31st December, 1897, being an account of the mining operations for gold, coal, &c., in the Province. 189 pp.

——— Report of Dairymen's Association of, for 1896-97. 44 pp., 4to. Victoria, B.C., 1897, 1898. *The Provincial Board.*

Brown, *W.* The Hygienic and Economic Value of Antiseptics in Urban Sanitation. 10 pp., 8vo. Reprint from Public Health. *The Author.*

Brownlee, *John, M.A., M.D., D.P.H.* Observations on the aerial transmission of the Enteric Fever Poison, with a record of an outbreak presumably caused by that means of Infection. 19 pp., 8vo. Glasgow, 1898. *The Author.*

Brussels. Annuaire Démographique et Tableaux Statistiques des causes de décès, 1896, par Dr. E. Janssens. 41 pp., 8vo. Bruxelles, 1897.

——— Instructions pratiques pour prévenir et combattre la Tuberculose. Rapport fait au nom d'une commission du conseil supérieur d'Hygiène publique par Dr. E. Janssens. 8 pp. 8vo. Bruxelles, 1895.

——— Rapport sur les opérations de la division d'Hygiène et sur la salubrité publique de la ville pendant l'année 1895. 39 pp., 8vo. Bruxelles, 1896. With other notes and reports. *Dr. E. Janssens.*

Canada. *Laboratory of Inland Revenue Department, Ottawa.* Bulletin No. 57, Aerated Waters; No. 58, Belladonna Plasters; No. 59, Infants' and Invalids' Foods. *T. Macfarlane, Chief Analyst.*

Corfield, *Prof. W. H., M.A., M.D. (Oxon.), F.R.C.P. (Lond.)* Dwelling-houses: their Sanitary Construction and Arrangements. 125 pp., 8vo. London, 1898. *The Author.*

Dibdin, *W. J., F.I.C., F.C.S.* The Purification of Sewage and Water (second edition revised and enlarged). 276 pp., 8vo. London, 1898. *The Author.*

Fairley, *Thomas, F.R.S.E.* On the Water Supplies of Yorkshire. 13 pp., 8vo. Reprint from the Journal of Federated Institutes of Brewing, Vol. IV., No. 5. May, 1898. *The Author.*

Janssens, *Dr. E.* Album de Statistique Graphique. Démographie et Hygiene. F.cap. Bruxelles, 1896. *Dr. E. Janssens.*

Janssens, *Dr. E.* Quelques considerations sur la Démographie comparée des arrondissements Belges en 1875-93. 17 pp., 8vo. Bruxelles, 1896.

—— Hygiene Publique—Instructions pratiques à l'usage des administrations communales pour prévenir et combattre la propagation des principales malodies Epidémiques et Transmissibles. 32 pp., 8vo. Bruxelles.

—— Statistique nosologique des décés constatès dans la population Bruxelloise pendant les vingt-quatre années 1867-1890 et classés d'après les années, les mois, l'age, le sexe, l'etat civil, le domicile la profession et la condition sociale, &c. 91 pp., f.cap. Bruxelles, 1890. *The Author.*

Japan. The Annual Report of the Health of the Imperial Navy for the 28th year of Meiji (1895). 67 pp., 8vo. Tōkyô, 1896.
Yasuzumi Saneyoshi, F.R.C.S. Eng., Director General.

Johannesburg. Annual Report relating to the Works Department of the Stradraad. By C. Aburrow, M.Inst.C.E. 31 pp., fcap. Johannesburg, 1897. *The Author.*

Kennedy, *A. Stoddard, L.R.C.S., L.R.C.P.Ed.* The Medical Treatment of the Drink Habit. 30 pp. London, 1898. *The Author.*

Latham, *Frank.* The Sanitation of Domestic Buildings. 132 pp., 8vo. London, 1898. *The Author.*

Leicester. Report to the Highway and Sewerage Committee on proposed New Tributary Sewerage, by E. G. Mawbey, M.Inst.C.E. 16 pp., 8vo. Leicester, 1898. *The Author.*

Local Government Board. Dr. G. S. Buchanan's Report upon the Sanitary Condition of the Urban District of Alnwick and upon the Housing of the Working Classes therein. 13 pp., fcap. London, 1898.

—— Dr. S. W. Wheaton's Report on the circumstances of the sources of Water Supply for the Borough of Carnarvon. 6 pp., fcap. London, 1898.

—— Dr. S. W. Wheaton's Report on outbreaks of Diphtheria at Marston, Hougham, and Long Bennington in the Claypole Rural District. 3 pp., fcap. London, 1898.

—— Dr. Wheaton's Report on the sanitary circumstances of the Bettwys-y-Coed Rural District, and on prevalence of Enteric Fever and Diphtheria in the district. 7 pp., fcap. London, 1898.

—— Dr. R. Bruce Low's Report on an Outbreak of Enteric Fever, in the Urban District of Camborne, and in portions of the adjoining Rural Districts of Redruth and Helston. 14 pp., fcap. London, 1898.

—— Dr. R. J. Reece's Report on Fever prevalence at Aldbrough in the Skirlaugh Rural District. 9 pp., fcap. London, 1898.
Sir R. Thorne, K.C.B., F.R.S.

London County Council. Filtration of Sewage: Report on the Bacteriological Examination of London Crude Sewage, by Dr. Frank Clowes (Chemist to the Council). First Report. 11 pp., fcap. London, 1898. *Purchased.*

Manchester Steam Users' Association. Memorandum by Chief Engineer, C. E. Stromeyer, M.Inst.C.E. 14 pp., 8v. Manchester, 1898. *The Author.*

Maxwell, *W.* Sewer Construction. 41 pp., 8vo. Reprint from *The Public Health Engineer*, London, 1898. *The Author.*

MEDICAL OFFICERS OF HEALTH AND OTHER SANITARY REPORTS.

Birmingham, 1897	*Alfred Hill, M.D., F.R.S.E., F.I.C.*
Birkenhead, 1897	*R. Sydney Marsden, D.Sc., M.B., D.P.H.*
Bridlington Urban, 1897 ..	*W. A. Wetwan, M.R.C.S.*
,, **Rural,** 1897 ..	*W. A. Wetwan, M.R.C.S.*
Brighton, 1897	*Arthur Newsholme, M.D.*
Cardiff, 1897	*Edward Walford, M.D., D.P.H.*
Cheshire C. C., 1897 ..	*Francis Vacher, F.R.C.S.*
Dumbarton C. C., 1897 (San. Insp.)	*David Dunbar.*
Durham C. C., 1897	*T. Eustace Hill, M.B., B.Sc., F.I.C.*
Hackney, 1897	*J. King Warry, M.D., M.R.C.P.*
Holborn, 1897	*W. A. Bond, M.A., M.D., D.P.H.*
Limehouse, 1897	*D. L. Thomas, L.R.C.P., D.P.H.*
Montreal, 1896	*Louis Laberge, M.O.H.*
Newport, 1897	*J. Howard-Jones, D.Sc., M.B.*
Northampton C. C., 1897 ..	*Charles E. Paget, M.R.C.S.*
Nottingham, 1897	*Philip Boobbyer, M.B.*
Poplar, 1897	*F. W. Alexander, D.P.H.*
St. Helens, 1897	*F. Drew Harris, M.B.Lond., D.P.H.*
St. Mary Abbott's Kensington, 1897	*T. Orme Dudfield, M.D.*
St. Olave's District, 1897 ..	*W. A. Bond, M.A., M.D., D.P.H.*
Wandsworth, 1897	*The Board.*
West Sussex, 1897	*C. Kelly, M.D., F.R.C.P.*
Wolverhampton, 1897 ..	*H. Malet, B.A., M.D.*

Metropolitan Asylums Board. Report for the year 1897 of the Statistical Committee, with Appendices. 206 pp., 8vo. London, 1898. *The Board.*

Michigan State Board of Health Proceedings and Addresses at a Sanitary Convention held at Detroit, Michigan, December 9th and 10th, 1897. 160 pp., 8vo. Lansing, 1898. *The Board.*

Muspratt, *Max, and* **Smith,** *E. Shrapnell.* Some Notes on the Disinfection and Deodorisation of Sewage with Chlorine. 7 pp., 16mo. Reprint from Journal Society of Chemical Industry, June 20th, 1898. *E. Shrapnell Smith.*

New South Wales. Report of the Department of Public Works for the year ended June 30th, 1897. 118 pp., fcap. Sydney, 1898. *The Agent-General.*

New South Wales. *Metropolitan Board of Water Supply and Sewerage.* Ninth Report for July 1st, 1896, to June 30th, 1897. 72 pp., fcap. Sydney, 1897. *The Agent-General for N.S.W.*

Ontario Provincial Board of Health. Sixteenth Annual Report, 1897. 318 pp., 8vo. Toronto, 1897. *The Board.*

Ottawa. *Laboratory of the Inland Revenue Department*, 1898. Bulletin 56. Fertilizers as sold in 1898. 13 pp., 8vo. Ottawa, 1898. *T. Macfarlane.*

Paris. Annales des Ponts et Chaussées. Mémoires et documents relatifs à l'art des constructions et au service de l'Ingénieur. Lois, Décrets, Arrêtés et autres concernant l'administration des Ponts et Chaussées. Personnel. 856 pp., 8vo. Paris, 1898.

——— 1^re^ partie, 1898. 2^e^ trimestre. 8vo. Paris, 1898.

——— Annales des Ponts et Chaussées. 1^re^ Partie: Mémoires et Documents relatifs à l'art des constructions et au service de l'ingénieur, 1898, 1^er^ trimestre. 474 pp., 8vo. Paris. *L'Inspecteur-Général Secrétaire de la Commission.*

Patent Office. Abridgments of Specifications, period 1889—92. Class 3, Advertising. 6, Agricultural Appliances. 9, Ammunition, Torpedoes, and Explosives. 15, Bleaching, Dyeing, and Washing Textile Materials. 21, Casks and Barrels. 22, Cements. 24, Chains, Electric Telegraphs and Telephones. 28, Cooking and Kitchen Appliances. 42, Fabrics. 49, Food Preparations and Food Preparing. 50, Fuel, manufacture of. 51, Furnaces and Kilns. 54, Gas Distribution. 56, Glass. 58, Grain and Seeds. 61, Hand Tools and Benches. 64, Heating. 68, Hydraulic Engineering. 70, India-rubber and Gutta-percha. 72, Iron and Steel Manufacture. 73, Labels, Badges, Tokens, and Tickets. 75, Lamps and Illuminating Apparatus. 77, Life-saving and Bathing Appliances. 79, Locomotive and Motor Vehicles. 85, Mining, Quarrying, Tunnelling, and Well-sinking. 89, Nails, Rivets, Screws, and like Fastenings. 91, Oils, Fats, Lubricants, Candles, and Soaps. 95, Paints, Colours, and Varnishes. 97, Philosophical Instruments. 98, Photography. 101, Printing. 102, Pumps. 103, Railway and Tramway Vehicles. 105, Railway Signals and Communicating Apparatus. 110, Rotary Engines, Meters, &c. 113, 114, 115, Ships, &c.; Divisions 1, 2, and 3. 116, Shop-fittings and Accessories. 119, Small-Arms. 120, Spinning. 122, Steam Engines. 123, Steam Generators. 126, Stoves, &c. 127, Sugar. 129, Tea, &c. 130, Tobacco. 131, Toilet and Hair-dressing Articles. 134, Umbrellas. 136, Velocipedes. 138, Washing. 142, Weaving and Woven Fabrics. 143, Weighing Apparatus. 146, Writing Instruments, &c. 4to. London, 1898. *H.M. Patent Office.*

Paterson, *Malcolm, M.Inst.C.E.* Compensation discharge in the Rivers and Streams of the West Riding (Yorks.) 55 pp., 8vo., London, 1896. *The Author.*

Polak, *Dr.* Annales de l'Institut d'Hygiène, de la valeur hygiénique du Pavage en Bois. 11 pp., 8vo. Bruxelles, 1898. *The Autho-*

Registrar-General, Ireland. Thirty-fourth detailed Annual Report, containing a general abstract of the numbers of Marriages, Births, and Deaths during 1897. 195 pp., 8vo. London, 1898. *The Registrar-General.*

——— **Scotland.** Forty-second detailed Annual Report on the Births, Deaths, and Marriages in Scotland (1897), (Abstract of 1896). 481 pp., 8vo. London, 1898. *The Registrar-General.*

Royal Observatory, Greenwich. Results of the Magnetical and Meteorological Observations made at, in the year 1895, under the direction of W. H. M. Christie, C.B., F.R.S., Astronomer-Royal. 172 pp., 5to. London, 1897. *The Astronomer-Royal.*

Schrevens, *Dr. E.* Rapport sur l'Hygiene de la navigation fluviale revières et canaux. 9 pp., 8vo. Extrait du Bulletin de la Société royale de Medicine publique de Belgique 1892. *The Author.*

Specification. For Architects, Surveyors, Engineers, when specifying, and for all interested in Building. No. 2, 1898. 499 pp., f.cap. London, 1898. *Builders' Journal and Architectural Record Company.*

Sutcliffe, *G. Lister G. (Editor).* The Principles and Practice of Modern House Construction. Divisional, Vol. I., 168 pp., 4to. London, 1898. *The Editor.*

Switzerland, Statistique de la. Résultats du Recensement Fédéral du Bétail du 20 Avril, 1896. 317 pp., 4to. Berne, 1898.

——— Examen Pédagogique des recrues en automne, 1897. 36 pp., 4to. Berne, 1898.

——— Annuaire Statistique de la Suisse. Septième année, 1898. 453 pp., 8vo. Berne, 1898. *Le Bureau de Statistique.*

Wilson, *F. R.* Lecture on "Water." 8 pp., f.cap. Alnwick, 1885. *Mrs. Topley.*

Wilson, *J. T., M.B., D.P.H.* The occurrence of Worm Nodules in the Lungs of Sheep. 7 pp., 8vo. Glasgow, 1893. *Dawson Williams, M.D., F.R.C.P.*

GENERAL NOTES.

The Fifth International Congress of Hydrology, Climatology, and Medical Geology, was held during the last week in September at Liége (Belgium), under the patronage of H. R. H. The Crown Prince of Belgium, the Honorary Presidency of M. de Bruyn, the Minister of Agriculture and Fine Arts, and the Presidency of M. Devalque, the Professor of Geology at the University of Liége. It was well attended by representatives of various nationalities.

Many important communications were read and discussed in the various Sections, among which was a very important paper by Dr. Kuborn (Hon Fellow of The Sanitary Institute), on "The Working of Mines in Belgium from the point of view of the Health and Safety of the Miners,"

and a most interesting Conference was given before the whole of the Congress by M. Walthere Spring, the Professor of Chemistry at the University of Liége, on the Colours of Natural Waters, in which he showed experimentally that the true colour of pure water is blue, as in the Lake of Geneva, and that this colour is the colour proper to the water, and is not due to a mere reflection from the surface or from suspended particles in the water. That when pure water has a very slight cloudiness due to the presence of finely divided nearly white or colourless particles in suspension, even if these are absolutely colourless, as in the case of very finely divided rock crystal, a yellow tint is given to the water, which, together with the natural blue proper to the water itself, produces a green colour, as in the cases of the lakes of Neufchatel and of Constance. He remarked that it had been noted by various observers that the water of certain lakes ordinarily green becomes occasionally absolutely colourless, and this he showed was due to the washing into the lakes of a fine mud of a reddish tint due to oxide of iron, which neutralizes the green colour of the water, rendering it for the time being perfectly colourless.

Interesting excursions were also made to the Bathing Establishments, and to inspect the sanitary arrangements of Ostend and Middelkerke, Spa, Chaudfontaine, and Aix-les-Bains.

The Sanitary Institute was represented by Professor Corfield, Vice-President of the Institute, who was elected an Honorary Vice-President of the Congress, and was also appointed the English member of an International Committee which was formed for the purpose of enquiring into the means to be adopted for the preservation of the purity of the sources of natural mineral waters.

Lectures and Examinations for Sanitary Inspectors.

As an illustration of the widespread influence exercised by the Lectures and Examinations of The Sanitary Institute, we give the following extract from *The Public Health Engineer* of September 10th, 1898:—"The *Indian Medical Record* announces that the Health Officer of Calcutta, Dr. J. N. Cook, D.P.H., in his note on the 'Health Department Budget Estimates,' makes the following suggestion: 'I would suggest for the consideration of the commissioners that, instead of appointing one of our present uncertificated sanitary inspectors, they should make it an acting appointment only, and advertise in the English papers for a certificated sanitary inspector who has been through the course at The Sanitary Institute and passed his examination, besides having practical experience in the work of a large town. I believe the services of such a man could be obtained for about Rs. 400 a month and horse allowance, and that he would prove more valuable for the class of work that has to be done than those of the R.E. officers and other gentlemen of high social and professional attainments. I do not consider that any one of the present staff of sanitary inspectors is properly qualified for the post in sanitary knowledge, or has the personal qualifications which are necessary for the efficient control of a large establishment. From this it would appear,' says the *Indian Medical Record*, 'that there is no place in India where men are trained in sanitary work. This is not to be wondered at, considering how much our whole educational system has fallen behind the times, and the snail's pace at which things move in India. We present the fact to the authorities as another direction in which reform is urgently needed. Will Surgeon-Major General Harvey, C.B., kindly make a note of this. We show in our editorial columns how the Government in its own admission has grievously failed in its efforts to educate medical men and nurses, but surely

it should not be beyond its power to turn out capable sanitary inspectors. There is plenty of material, and examples of how things *should not be done*, to provide valuable instruction for the responsible authorities."

Meat Inspection and Public Slaughter-Houses.—The Public Health Committee of the London County Council have issued a report which, if carried into effect, would meet several of the recommendations made by the Royal Commission on Tuberculosis. The Committee state that in his report upon the subject, the medical officer of health showed the inadequacy of the inspection of meat consumed in London, and pointed out that to ensure the proper inspection of meat killed in London he considered it absolutely necessary that all animals should be killed in public slaughter-houses, in which alone due inspection was possible. It appears that the greater number of animals now slaughtered in London are killed in the slaughter-houses of the Corporation of the City of London at Deptford and Islington, but information obtained from occupiers of private slaughter-houses, of which there are some 450 in London, shows that in winter some 900 beasts, 7,000 sheep, and 900 pigs, and in summer 800 beasts, 11,000 sheep, and 500 pigs are killed per week in these premises. The systematic inspection of these animals is impossible in view of the numerous premises in which they are killed. The medical officer is, therefore, of opinion that it is desirable to afford butchers the opportunity of killing animals in some half-dozen public slaughter-houses to be owned by the Council. The first step should be to require that all animals slaughtered in London should be killed in public slaughter-houses, and that stations should subsequently be provided for the examination of all meat killed in other parts of the country, and not already subjected to inspection in public slaughter-houses. The Committee point out that they have carefully considered the recommendations of the Royal Commission on Tuberculosis, and that with these recommendations and the views expressed by the medical officer they entirely concur. The question necessarily arises whether the provision of public slaughter-houses and stations for the inspection of meat will involve cost to the ratepayers. They think that every effort should be made to render these places self-supporting, but that it would be futile at present to attempt to submit estimates, as so much will depend upon the locality of the sites, the circumstances of the trade, and the character of the buildings.

Kenny & Co Printers 25 Camden Road London N.W

Volume XIX.—Part IV.] [January, 1899.

JOURNAL
OF
THE SANITARY INSTITUTE.

CONGRESS AT BIRMINGHAM.
SECTION I.
SANITARY SCIENCE & PREVENTIVE MEDICINE.
PAPERS AND DISCUSSIONS.

"*Endemic Typhoid Fever in Nottingham,*" *by* PHILIP BOOBBYER, M.B., M.O.H., Nottingham.

(FELLOW.)

THE subject of endemic typhoid fever in towns is becoming, I know, somewhat stale, and especially to those who do not see much of the disease; but the only course open to Medical Officers of Health like myself, who happen to be connected with centres of population having a persistently high annual typhoid death-rate, is to press the subject until public opinion comes to our aid and demands the prompt removal of those conditions which can be shown to foster the disease.

To this end I have already published in my Annual Health Reports for Nottingham (from 1892 onwards) some of the facts and figures contained in this paper, but not any of them have hitherto appeared in a separate paper, and many of them are entirely new. In the first place I shall reproduce a table which I prepared for my 1896 Report, showing almost at a glance the incidence of typhoid fever in Nottingham upon houses furnished with pail-closets, midden-privies, and water-closets respectively.

ENTERIC FEVER IN NOTTINGHAM, 1887—96.

Cases and proportion of cases in Houses furnished respectively with Pail-Closets, Midden-Privies, and Water-Closets.

1887.

HOUSES.			CASES.		RATIO.	
35,786	Houses with	Pail closets ...	369 cases	= 1	case in 97	Houses.
1,598	,, ,,	Privies ...	45 ,,	= 1	,, in 35	,,
6,000	,, ,,	W.C.'s ...	12 ,,	= 1	,, in 500	,,

1888.

Houses.				Cases.		Ratio.	
37,038	Houses with	Pail closets	...	354 cases	= 1	case in 104	Houses.
1,532	" "	Privies	...	29 "	= 1	" in 52	"
6,091	" "	W.C.'s	...	11 "	= 1	" in 554	"

1889.

37,539	Houses with	Pail Closets	...	326 cases	= 1	case in 115	Houses.
1,343	" "	Privies	...	31 "	= 1	" in 43	"
6,200	" "	W.C.'s	...	10 "	= 1	" in 620	"

1890.

38,133	Houses with	Pail closets	...	305 cases	= 1	case in 125	Houses.
1,195	" "	Privies	...	20 "	= 1	" in 52	"
6,280	" "	W.C.'s	...	9 "	= 1	" in 694	"

1891.

38,571	Houses with	Pail closets	...	337 cases	= 1	case in 114	Houses.
880	" "	Privies	...	27 "	= 1	" in 33	"
6,295	" "	W.C.'s	...	11 "	= 1	" in 572	"

1892.

38,834	Houses with	Pail closets	...	178 cases	= 1	case in 218	Houses.
711	" "	Privies	...	12 "	= 1	" in 59	"
6,360	" "	W.C.'s	...	8 "	= 1	" in 795	"

1893.

40,097	Houses with	Pail closets	...	435 cases	= 1	case in 92	Houses.
600	" "	Privies	...	19 "	= 1	" in 31	"
7,000	" "	W.C.'s	...	25 "	= 1	" in 280	"

1894.

40,414	Houses with	Pail closets	...	304 cases	= 1	case in 133	Houses.
500	" "	Privies	...	20 "	= 1	" in 25	"
7,000	" "	W.C.'s	...	10 "	= 1	" in 700	"

1895.

40,532	Houses with	Pail closets	...	385 cases	= 1	case in 105	Houses.
460	" "	Privies	...	23 "	= 1	" in 20	"
7,100	" "	W.C.'s	...	14 "	= 1	" in 507	"

1896.

40,225	Houses with	Pail closets	...	400 cases	= 1	case in 101	Houses.
440	" "	Privies	...	24 "	= 1	" in 18	"
7,200	" "	W.C.'s	...	20 "	= 1	" in 360	"

If we summarise the figures for the ten years, we find that the annual average rate of incidence upon each class of house has been as follows:— (1) upon pail-closet houses, 1 case in 120; (2) upon midden-privy houses, 1 case in 37; and (3) upon W.C. houses, 1 case in 558. In other words, the proportional incidence of the disease upon houses with privies was more than three times as great as that upon houses with pail-closets, and that upon houses with pail-closets more than 4½ times greater than that upon houses with W.C.'s. The different types of closet are intermingled in all parts of the town, and, except

in distinctly good neighbourhoods, the incidence and ratio of incidence is remarkably general and uniform.

I am dealing here for the most part, it must be remembered, with endemic typhoid, a disease which recurs year after year, in varying amount truly, but still almost always in sufficient quantity to produce an annual death-rate of more than 0·25 per 1,000.

It may be as well to explain precisely what I mean by speaking in this way of endemic typhoid fever. I am not for a moment contending that our local typhoid is only propagated by such agencies as foul soil, premises, and general surroundings. Its history is of course insterpersed with water-, milk-, and food-borne outbreaks. My only contention is that the greater part of our annual visitation, year by year, is due to the former agencies.

Occasional epidemics affecting all classes of houses and people in certain districts almost uniformly, and propagated by infected water, milk, and the like, can be distinctly traced in one of my tables, dealing with the proportional incidence of the disease in successive years upon houses of different classes, by the effect they have in levelling up the incidence.

The annual death-rates from enteric fever in Nottingham from 1888 to 1897 inclusive were as follows :—

1888	1889	1890	1891	1892	1893	1894	1895	1896	1897
0·40	0·28	0·29	0·32	0·16	0·31	0·28	0·24	0·34	0·21

The average annual rate for the ten years 1888–97 was 0·28, and for the immediately preceding decennium 0·31. These rates are, of course, much higher than they should be in a remarkably clean and well sewered town like Nottingham, provided moreover with an excellent public water-supply. There has been little real decline, if any, in the local typhoid death-rate in twenty years.

If proof were wanted that the disease, as we know it generally, is not—as has been suggested—propagated by our water, it could be found in the fact that, although our water-supply is all derived practically from one source (deep borings in "Bunter Sandstone"), the disease is never altogether general in its distribution about the town, or even in sections of the town supplied from one well or reservoir: its incidence is much heavier upon the poorer neighbourhoods than the well-to-do. When introduced into a good neighbourhood it sometimes remains for a time, but the spot-maps of recent years which were passed round show at a glance, to anyone acquainted with Nottingham, that the better parts of the town are, as compared with the poorer, practically free from the disease. The superior

neighbourhoods are not by any means exclusively furnished with W.C.'s. Round the central parts of the town, indeed, there are a very large number of pail-closets: it is only the midden-privies that have disappeared from this region. There is one very important particular, however, in which the outside premises of houses in the better neighbourhoods differ from those in the poorer, and of this I wish you to take special note. The yards and passages of the former are almost invariably well-paved and drained, whereas those of the latter are often seriously deficient in this respect. It must not be hastily inferred that we of the Health Department are neglecting our duties in suffering a continuance of these latter conditions. There are many outlying parts of Nottingham which a short time back were simple country villages. Small gardens in such districts rapidly degenerate into dirty patches of waste land devoid of vegetation, as buildings and population of the poorer class thicken upon the ground. The absence of vegetation is here probably a very important matter. Now we cannot reasonably demand that what has been a back garden (say 60 feet to 100 feet long) shall be completely paved over, but certainly nothing short of this is required if we would protect the local population from soil-bred diseases, especially when we recollect that the contents of privies and pails frequently find their way to the surface of the soil around them.

There is probably very little to be learnt with respect to the causes of the varying distribution of the disease in Nottingham from a study of the local geology. All the densely inhabited central parts of the town are built at various levels upon pebble beds on conglomerate, but there are besides alluvium and gravels of the Trent and Leen, mottled sandstone, red marls, magnesian limestone, and the coal measures, lying grouped around this central portion. Upon the uniform central part however we find at different parts the most unequal incidence of the disease. The character of the subsoil appears to be uniform: the only points of differentiation lie above the natural surface. A study of the geological maps with the spot maps issued in my recent Annual Reports of Nottingham will enable anyone sufficiently interested in the subject to make the comparison to gauge the accuracy of my remarks. Both sets of maps have contour lines, plainly marked with heights above ordnance datum. I may observe, in passing, that our local experience does not appear to lend much support to Pettenkofer's theory with regard to the causative relation of a falling and rapidly fluctuating subsoil water in impure and porous soils to the genesis of typhoid fever. Although we have the seasonal fluctuations of the disease usual in these regions, we do not find

that they are necessarily much more marked in low-lying districts with porous and wet sub-soils than in those standing high and dry on the solid rock.

I shall now give some figures shewing the incidence of cases upon houses of 5 rooms and under, and those of larger capacity respectively, during the ten years 1887–96.

Year.		Total cases of Enteric Fever.	Cases in houses of 5 rooms and under.	Cases in houses of more than 5 rooms capacity.
1887	...	426	340 (80 °/₀ of all)	86 (20 °/₀ of all)
1888	...	394	340 (86·3 °/₀ of all)	54 (13·7 °/₀ of all)
1889	...	367	305	62
1890	...	337	288	49
1891	...	375	325	50
1892	...	198	156	42
1893	...	479	411	68
1894	...	334	298	36
1895	...	422	368	54
1896	...	444	390	54
Total in 10 yrs.		3776	3221 (85·3 °/₀ of all)	555 (14·7 °/₀ of all)

It may be noticed that I have not given the figures for 1897. These are omitted on account of the wholesale disturbance of large neighbourhoods produced by the carrying out of the new works of the Great Central and Great Northern Railways, which first came into serious operation during 1897.

The houses containing five rooms and less certainly do not constitute more than from 45 per cent. to 50 per cent. of all houses in Nottingham. Still, in the ten years 1887 to 1896, more than 85 per cent. of all typhoid fever cases registered occurred in such houses, leaving less than 15 per cent. to those of larger dimensions.

The seasonal distribution of the disease shows considerable variation according to the type of closet. During the five years ending with 1896, the totals of the quarterly numbers of cases recorded in successive quarters, in houses furnished with pail-closets, privies, and W.C.'s respectively, were as follows:—

Type of Closet.	5 years, 1891—1896. 1st Qrs.	2nd Qrs.	3rd Qrs.	4th Qrs.
Pail-closet ...	365 cases.	206 cases.	512 cases.	619 cases.
Midden-privy.	23 „	19 „	26 „	31 „
W.C.	16 „	6 „	25 „	30 „

If we divide the pail-closet numbers by 20, the quarterly figures for this type become

18 cases, 10 cases, 25 cases, 31 cases,

and are comparable at a glance with those of the privy and W.C. These latter numbers are relatively small, but this is a

defect which cannot now be obviated; they must be taken for what they are worth. It is hardly necessary to say that the figures for the second quarters (in their relation to the rest) are those which here claim our special attention.

The numbers of privy cases show a remarkable degree of uniformity throughout the year, the total for the second quarters being equal to just a fifth of the annual total. Next in degree of uniformity come the pail-closet cases. The number of these in the second quarters is equal to nearly an eighth of all. Last come the W.C. cases. The number of these in the second quarters amounts to only one-thirteenth of the total for the years. If these figures suffice to show anything at all, they undoubtedly indicate a tendency on the part of the conservancy closets to produce an endemic continuity of cases—as I have previously argued—through pollution and infection of premises and soil, and a lack of such tendency on the part of the W.C. The history of the local recurrence of cases, however, is a somewhat curious study. There are localities—which can be readily picked out on the spot maps—from which the disease is hardly ever absent, but even here it seldom in my experience remains endemic for long at one exact spot, or in one house. It shows a decided tendency to shift about. In one street at Radford, the houses of which have midden closets almost exclusively, I have made the following record of cases in successive years:—

1895. 3 cases in May and July.
1896. 4 cases in March, August, and October.
1897. 4 cases in January, July, and September.

But only four of these eleven cases occurred as secondary cases in houses previously invaded.

In another street in the same district, furnished with pail-closets, fifteen cases were spread over the four years, 1894—1897, and the same number only of secondary cases in identical houses occurred here also. Large unpaved yards or ragged back gardens adjoin the rears of most of the houses in both these streets.

During 1897 there were 56 secondary cases of enteric fever, within the year in houses previously invaded, recorded in Nottingham. All these occurred in houses furnished either with midden-privies or pail-closets, none in those with W.C.'s, though the latter now constitute from one-fifth to one-fourth of all, and are scattered all over the town.

Let us now bring to a focus the conclusions to be derived from the few facts and figures I have here laid before you. The conclusions, I take it, are briefly as follows:—

1. That conservancy closets—privies and pail-closets—as we

know them, not as theorists paint them—are capable of playing a very active part in maintaining and propagating endemic enteric fever.

2. That their capacity in this respect, and for obvious reasons, is greatly augmented by an unpaved condition of courts, alleys, and yards, and all that the expression "a dense and poor neighbourhood" connotes.

3. That the comparative immunity from typhoid incidence of decently built modern houses with W.C.'s can be seen even in towns where typhoid fever is and has been endemic for many years, and also even in the poorer neighbourhoods of these towns.

No paper on this subject is now complete without some reference to the very important experiments recently carried out by Drs. Sydney Marsden and John Robertson, upon the behaviour of Eberth's bacillus in polluted and unpolluted soils. These investigators have shown that the typhoid bacillus is capable of living and growing and spreading in the superficial layers of organically polluted soils, while failing altogether to retain its vitality in virgin soils. The importance of the results achieved by the experiments of these investigators cannot, in this connection at any rate, be over-rated. These results should bring home even to the most careless and sceptical of intelligent minds the real danger of so-called conservancy closets, and also that of unpaved ground surfaces around the latter in the near neighbourhood of town dwellings.

These bacteriological facts are of such singular interest in connection with the subject of my paper as to demand at least a passing notice, but space forbids me to discuss the experience kindred to my own of other observers in the public health service. My object to-day has been to lay before you as briefly as possible a few facts culled from my own personal experience of recent years, with the conclusions to be drawn from them. I see, however, many gentlemen now before me who can supply, if they will, on the best possible authority, much of what for lack of time I have been compelled to omit.

Dr. Cooper Pattin (Norwich) regretted that he had not had an advanced syllabus of the subjects to be discussed at this meeting, because a little time ago he read a paper before the Epidemiological Society in London on Enteric Fever in Norwich, which covered much the same ground as Dr. Boobbyer had so ably gone over. He found, as Dr. Boobbyer proceeded, that there were many points of likeness between Nottingham and Norwich, and also of contrast. Dr. Boobbyer spoke of Nottingham as an ancient place, and he could

claim for Norwich that it was even more ancient, and that it had been for about a thousand years at any rate a relatively populous place. Besides being ancient it was extremely picturesque, and in addition was a cathedral city, and therefore they would know that many old institutions flourished within it. Geologically also it was somewhat like Nottingham in this sense; the soil of Norwich was practically all chalk. They had chalk to 1,000 feet in depth practically over the whole of the inhabited area of the city, and it was cropping up constantly to the surface. There was one relatively small area over a bed of clay, but practically they might take it that Norwich stood on a chalk formation. With regard to the areas in the city that had been affected by typhoid fever, he found the disease had been very generally distributed during the time he had been there. There were only two districts that had had any special incidence of the disease, and these two were on the high ground—one on an escarpment of the hill running down from the higher parts of the city to the lower—and in that area there were connections with a low-lying and unquestionably defective sewer. Now, for the most part, in this particular area, ventilating shafts had been erected at higher levels, and whether it was that practically the whole population had immunized itself by having typhoid, or whether this alteration in the ventilating arrangements had brought about the improvement, the fact was that typhoid there was relatively less than it was before. The water in Norwich, like that of Nottingham, was very good. Speaking from memory, he should say that 85 per cent. of the houses were supplied with the Company's water, but about 15 per cent. still drew their water from wells. He was satisfied, however, that the well water had no more to do with their typhoid than had the pipe water. As a matter of fact the figures made the proportion of typhoid cases in houses supplied with the Company's water about one-half per cent. worse than those drawing their water from the wells. All the same, he was advising his Council, constantly, to have these wells closed, and whenever it could be shown, by analysis, the water to be sufficiently polluted, this was done. He practically put out of Court water as the constant and common cause of the typhoid which had existed in Norwich. They had notification evidence of it for eighteen years, and it had been in existence there for all living memory, and he should say for very much longer. Then, with regard to the houses, Dr. Boobbyer did not mention whether he restricted his five-roomed houses to houses which had five bedrooms. The experience in Norwich was that directly families got into a house with four or more bedrooms the incidence of the disease became remarkably lower. A very large proportion of the yards in Norwich were, like those of Nottingham, unpaved, and the soil must be riddled and polluted with organic matter. He had calculated the number of tons that were practically dumped down on to the soil of Norwich in a year, and it came out at a very big figure. The Committee and himself had very great difficulty in getting these Courts paved, but it was a thing they were very anxious to accomplish. Ninety per cent. of the cases of typhoid at Norwich occurred at houses where the

excrement was retained in the neighbourhood of the dwelling, and soil-pollution, in his opinion, was the real cause of the typhoid fever which, in Norwich, as in Nottingham, they had, like the poor, always with them.

Dr. EUSTACE HILL (Durham) said they were very much indebted to Dr. Boobbyer for introducing this discussion. For some time past, he thought, sanitarians had been changing their opinions that typhoid fever was invariably caused by pollution of the water or milk supply, and had now come to regard its prevalence in many parts of the country as due to other causes, such as those to which Dr. Boobbyer had referred. He himself came from a part of the country where for years enteric fever had not only been endemic, but exceptionally prevalent. In fact, the Registrar-General had in several of his annual reports referred to the fact that in the north-eastern part of England, of which Durham formed the centre, enteric fever had been more prevalent than in any other part of the country. It had been the subject of inquiry by several medical officers of the Local Government Board, and one of the best-known reports was that of the late Dr. T. W. Thompson, in which the writer dealt in the fullest manner possible with the probable causes of the disease as it affected the county of Durham. He went fully into the questions of water supply, milk, and such conditions as Dr. Boobbyer referred to, and practically excluded from amongst the causes of the disease both the water and the milk supply. Of course there were in certain portions of the country water supplies which were admittedly dangerous, but as causes of the general prevalence of enteric fever, the public water and milk supplies were for the most part excluded. The investigation practically proved, and his own experience was in accord with the conclusion, that it was the means of excrement disposal in the north of England which was the prime cause of the endemic prevalence of enteric fever. A few years ago the midden privy was practically the only system of excrement disposal in that part of the country, and personally he had not the slightest doubt that this was the chief cause. The investigations carried out by Dr. Sydney Marsden and Dr. Robertson, clearly proved that organic pollution of the soil is one of the chief factors in the prevalence and the spread of typhoid fever, and such pollution is unavoidable where the midden privy system is in operation. Then again, in the county of Durham, up to recent times, open channels were commonly used as a means of drainage, instead of properly trapped house drains and covered sewers. In many colliery districts the only system of disposal of the slop-water and sewage consisted of open channels, which often flowed within two or three feet of the only door and window of the dwelling. The result was that slops and other excrement were thrown out on to the ground about the channels by careless tenants who would not take the trouble to pour them down the channel. Very often, in addition, the channel was defective, and thus they got the pollution of the soil and sub-soil, which the researches of Dr. Marsden and Dr. Robertson proved to be

such a permanent cause of enteric fever. Not only did pollution of the soil occur from these open channels and the abominable midden privy system of excrement disposal, but in the cleansing and emptying of the ashpits and privies there was very great danger. Owing to the endemic prevalence of enteric fever, there was no doubt that the ashpits and privies frequently became contaminated with specifically infected excreta; and he was sorry to say that it was a common practice of medical men in colliery districts to advise the burial of the excreta of typhoid patients in the ashpit. It could not be too well known that this was a practice fraught with danger which should by all means be discontinued. In most colliery villages, privies and ashpits were cleaned out in the daytime, very often at the time the people were having their meals, and the dust, probably infected, was scattered all about the street and carried in through the doors and windows of the houses, to settle on the food. Then again in warm weather flies abounded in all places where there was much decomposing animal organic matter, and he had no doubt that flies were frequently a means of spreading the infection of enteric fever. The relationship between occupation and the prevalence of enteric fever in some districts also required to be considered. In the report of the Local Government Board for 1897, Dr. Bulstrode showed that practically for the last twenty years the greatest prevalence of enteric fever had been found in the north-east of England, Lancashire, and South Wales, and these districts were, they might say, the chief coal-mining districts of the country. Frequently it happened that a coal-miner when attacked by enteric fever did not at once take to his bed, but continued to work until his illness absolutely prevented him, and there was no doubt that in such a condition he would frequently have to go to stool down the pit where, in many instances, there were no means provided for excrement disposal. The result was he went into an old working and deposited his excreta in a place where the temperature was particularly favourable to the development of the typhoid germ, and it was more than possible that the disease might be spread among other workers in the pit. He thought that the question as to how far the prevalence of enteric fever in the coal-mining districts had to do with the particular occupation of the inhabitants of those districts was worthy of more attention than it had up to the present received.

Dr. Scurfield (Sunderland) said he was medical officer of a town which, like Norwich and Nottingham, suffered from an endemic prevalence of typhoid fever. The water-supply somewhat resembled that of Norwich and Nottingham, in that it came from deep wells (sunk through the magnesian limestone) situated outside the area of the borough. As the same water company supplied many of the districts outside the borough, it was easy to prove that the water-supply had nothing whatever to do with the prevalence of typhoid fever in Sunderland. They had no private wells used for drinking purposes inside the borough. In 1895 they had one milk epidemic which accounted for about one hundred and fifty cases; but during 1896 and 1897 they had had no cases, which they had been able to

trace to milk. He held the same opinion for Sunderland as Dr. Boobbyer did for Nottingham, namely, that they must look to the soil pollution for the cause of the endemic prevalence of typhoid fever. With a population of 140,000, they had 12,000 old-fashioned open privy middens which had to be cleaned by pitching the contents on to the streets, and these open privy-middens he thought were the prime cause of the endemic prevalence of typhoid fever in Sunderland. Sunderland was built on magnesian limestone, but separated from it by an almost continuous covering of boulder clay, often 50 feet thick. The distribution of typhoid had been general, and he had noticed no difference between the districts where the sub-soil was stiff clay, and those where there was gravel lying on the top of the clay. They collected the excreta of typhoid patients treated at home, in pails with air-tight covers, but before this collection began there was no doubt that the excreta of typhoid patients found their way into the midden both during the period of the illness before notification, which usually extended to ten days, and during the period of convalescence, before the motions ceased to be infectious. This danger, of course, would not occur in a water-closet town. A midden would often become infected in these two ways even when they removed the typhoid excreta in pails. Each time the midden was cleansed the street became infected; children played about in the back streets, rubbing their hands in the dirt, carried it to their mouths, and got typhoid in that way. Flies from the midden settled in the milk, and conveyed typhoid fever in that way. He quite agreed with Dr. Hill that flies were a most important means of spreading infection. Typhoid fever in Sunderland had been noticed to cling to clusters of houses. It occurred, for instance, in one house in 1893. A house on the opposite side of the street would show a case in 1894. Then there would be cases in 1895 at the house of the next-door neighbour to the original house, and so on. These cases occurring in clusters year after year, he thought strongly supported what had been proved by the experiments of Dr. Robertson and Dr. Sydney Marsden, as to the ability of the typhoid bacillus to live in the soil for long periods. He did not know whether the audience had heard of a case which occurred at Eccles, where Professor Sheridan Delépine isolated the typhoid bacillus from the filth-saturated mortar of a privy-midden thirteen months after the occurrence of a case of typhoid in the house, and this, too, in spite of the fact that the endeavour had been made to disinfect the privy-midden in question. This case was a very important confirmation of the experiments of Dr. Marsden and Dr. Robertson.

Lieut.-General Phelps (Birmingham) thought Dr. Boobbyer had established the fact that the incidence of the disease was worse generally in the low-lying parts of the town. He had mentioned the presence of disused wells in the area of the town, the wells which gave the present supply being outside the area. Possibly it might be that the discontinuance of those sources of supply which formerly lowered the sub-soil water had brought their old enemy—damp, and

so made enteric fever cling to the low-lying parts. A matter which threw a good deal of light upon all questions connected with typhoid fever was its incidence on the young soldiers in India. They went there between 18 and 20, or 22 years of age, and they had gradually become more and more liable to typhoid fever as time had gone on, although every cause that had been suggested, with one or two exceptions, had been eliminated. There was no soil-pollution allowed round the barracks; every article of food, every beverage had been carefully analysed; all that science could do to exclude every possible cause of disease had been attended to. Still the medical officers of health in India had been obliged to confess themselves entirely unable to account for the incidence of typhoid fever there. No doubt in India flies were a great nuisance, as they were here, and might quite possibly be a source of contamination. In Birmingham the question of the sub-soil water was one that affected them very closely. They expected in four years to have the most plentiful, the most bountiful, supply of water any town could wish to have; but it would, he was afraid, result in the disuse of all the deep wells which the city at present drew from, and this would inevitably be followed by an increase of the level of sub-soil water. Thus, when the new water came to Birmingham, they might look forward to an increase of the damp, and when this came creeping towards the surface, they might expect the city would from that cause suffer a re-action. The question of water, the question of milk, the question of soil-pollution here, as in India, had been examined and found to be insufficient to account for the prevalence of enteric fever. Might he suggest there was one more possible source which had not been considered, and which he thought might possibly be the nidus from which this disease germ was diffused? Had it been sufficiently ascertained whether the sources of vaccine lymph were free from contamination? There was the question of the possible pollution of the blood by the inclusion of this disease germ in lymph. Dr. Hill had made an admirable suggestion with regard to milk—that it should be labelled with the name and quality of the preservative, and that it should be thoroughly analysed before diffusion. Now might they not ask that vaccine lymph should be subjected to the same tests? They would thus eliminate this one possible source of contamination. It was a question and should be settled scientifically. If they found it was so, then the elimination of this one possible cause of the diffusion of disease would be a very great service on the part of the Congress.

Dr. Waters (Southend) expressed his personal thanks to Dr. Boobbyer for having introduced the subject. Four years ago, he had stated in his first annual report that in his opinion the cause of the endemic prevalence of typhoid fever in Southend was due to pollution of the soil. In the following year he had experiments made with the soil from houses in which typhoid fever had been present. In one, typhoid fever had been present six months before the experiments were made, and in that case a bacillus resembling the bacillus of typhoid fever was found. In this connection he instanced

his own council as one that had followed upon the true lines of progress. At first certain members were much against the use of the word endemic, but he continued to use the word, and had used it year by year. He recommended the council to have every house in the borough tested with the water test, and last year, with the help of some additional inspectors, they tested no less a number than 786. A large majority were defective. He further recommended that all back passages should be made up, and this was also being done. He thought he was justified in instancing his council as one of the progressive kind, and instead of getting rid of their medical officer, they made his appointment a permanent one.

Dr. CHARLES PORTER (Stockport) said he never came to the interesting Congresses of the Sanitary Institute without taking a great deal of information away with him, but never had he heard a more novel suggestion than that typhoid fever was conveyed by vaccine lymph, a statement which illustrated the parlous condition to which anti-vaccinationists are reduced for honest argument. As to Dr. Boobbyer's paper, he thought all health officers would agree as to the typhoid-producing effects of soil-pollution, and not typhoid-producing effects alone, for what affected Stockport especially was the enormous amount of infantile diarrhœa from soil-pollution and food-pollution. He was a determined opponent of midden privies and clay-jointed drains as causes of soil pollution. In the north of England, at any rate up to very recent years, he did not think anybody had an idea of what a water-tight drain was. As to Prof. Delépine's Eccles experience, Dr. Scurfield was perhaps not aware that the privy-pit at the houses in question was repeatedly disinfected with the very strongest disinfecting solution that could be obtained. He knew it was disinfected three times by a most expert inspector, and it was after these repeated disinfections that the typhoid bacillus was found by Prof. Delépine in the detritus from the privy-pit floor. It was argued by Counsel for the property-owner that, because these three disinfections had not killed the baccili, scavenging had not been carried out properly by the Corporation. The assertion was often made, in discussing the demerits of privy-pits, that many of the evils ascribed to them were due to other insanitary conditions of the dwellings so served, and he had therefore recently classified the houses in the borough of Stockport, according to their rateable value, and had arranged them, partly at the suggestion of Prof. Delépine, in two divisions, equal in all sanitary respects, except that one was provided with water-closets and the other with privy-pits. He then went into the question of the incidence of typhoid fever in these two classes of dwellings for five years, and the figures obtained were most remarkable. Taking the whole of them and dealing with some 18,000 houses, the incidence per cent. on houses provided with privy pits was 3·39, whilst the incidence on houses provided with water-closets was 1·21. Taking both classes, it was a remarkable fact that the prevalence of typhoid fever on both privy-pit houses and water-closet houses increased with the rateable value. One has been taught that

typhoid fever was very often more usual amongst the middle classes, and these figures brought the fact out in a striking manner. For instance, taking houses under £5 a year, the very poorest class in the borough, the percentage of typhoid-incidence with privy-pits was 1·92; with water-closets 0·56. Coming to houses of £14 to £20, the typhoid incidence in privy-pit houses was 4·57; in water-closet houses 1·30. In the £30 houses and upwards, the percentage was 5·44 in privy-pit houses, and 2·43 in water-closet houses. Although the incidence on all houses appeared to increase as the rateable value increased, at the same time the greater incidence on privy-pit houses was maintained throughout. He contended, however, that apart from all figures, the evidence one got by going into crowded courtyards and finding time after time nothing but the history of an infected midden-privy to account for the yard being spotted with cases of typhoid, was far more convincing. In 72 of the 450 odd cases at Stockport during the five years referred to, the typhoid infection of the privy-pit with typhoid-discharges was followed by one or more cases amongst those who subsequently used the privies. There could be no question whatever that soil-pollution was a terrible cause of typhoid fever and of much infantile diarrhœa which exerted a fearful influence upon the death-rate; and it was some satisfaction to know that the sanitary authorities in the towns affected were beginning to realise the fact.

Mr. H. Williams (St. Austell) asked what means could be applied to force the hand of local authorities, manufacturers, landlords, and others, to promote those sanitary measures which they knew were beneficial and led to the preservation of health. He mentioned a case where at a meeting of an urban authority a drainage scheme was suggested for consideration, and the Chairman advised the Council to keep the matter back until they were compelled to do something by the Local Government Board.

Dr. Clare (Hanley) said he had been much struck by the paper, inasmuch as at Hanley they had the same arrangement—privies, pail-closets and water-closets. He wished to point out, however, that there were different kinds of water-closets; there were the hand-feeding closets, slop-closets, and water-closets proper, with a cistern. He had found cases of typhoid fever most frequent with the pail-closets, next with the hand-feeding water-closets and slop-closets, next with privies, and next with proper water-closets. He thought that where water-closets were used in a town it was well to define what was meant. It should be a water-closet with a proper cistern to feed it, and not a hand-fed closet or slop-closet, and that not only for sanitary reasons but also to prevent the waste of water which in a dry season like the one they were then experiencing was a point that ought certainly to be considered. In his own town the authorities came to loggerheads with the Water Company who said, and with great truth, that wherever the hand-fed closets or slop-closets were used it was not a case of slop-water only but a case of any amount of

waste. The Company felt so strongly on the point that they threatened, if the town persisted in allowing these closets to be laid down, to take into consideration the question of using meters in the streets to measure the water. He noticed that in Birmingham there was talk of a possible scarcity of water and he thought that where water-closets were used it was important they should be of the proper kind and not of the kind he had mentioned.

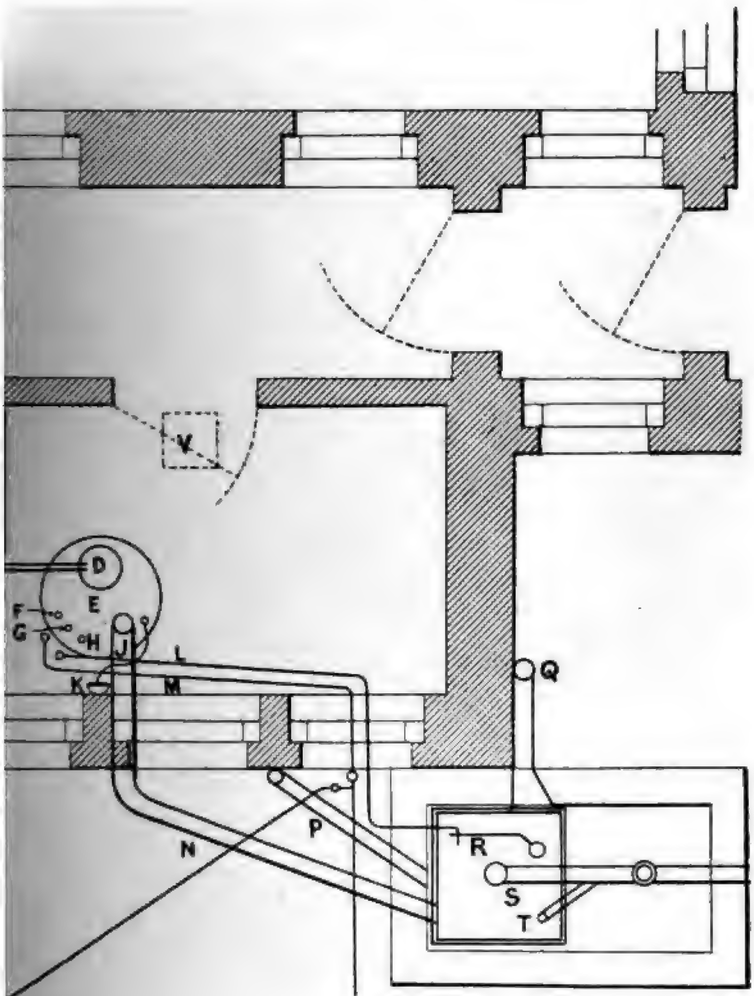
Dr. J. F. J. SYKES (St. Pancras) asked Dr. Boobbyer to give in his reply some idea of what the common factors were amongst the people who were put by him into the several classes, because that must enormously influence the result of the figures. The possible factors must be water, food, or air, and if it were food the food might be polluted either by milk or in various other ways, or by home nursing, and the question of the length of time in which cases were retained at home before they went to the hospital must have an important bearing quite apart from the infection of the privy. The prolonged exposure to unskilled nursing in their own homes must be an important factor, and he wished to know whether this point had been worked out by Dr. Boobbyer. At the same time he wished to point out that the figures quoted by Dr. Boobbyer showing that the typhoid incidence increased in all houses according to the rateable value applied to both his classes. They applied equally to the privy houses and to the water-closet houses, both increased in a parallel ratio. That meant, of course, that the infection was due to the nursing at home, because the better the class of person the longer the case was kept at home, and the larger the number of cases kept at home. This was an extremely important factor which ought to be reckoned with.

Mr. BAKER (Maidstone) who announced himself as a Councillor of that unfortunate town, said he was glad that typhoid fever was not endemic there. It had been established by the verdict of the Local Government Board, that the recent outbreak was caused by water-pollution, and they wanted to know in Maidstone how far chemical analysis would protect a town during an epidemic of typhoid fever, and how often this chemical analysis should be taken. This was still a vexed question at Maidstone. Most of them were of opinion that if they had had a more frequent analysis of the water the recent epidemic might have been avoided or mitigated. This was an important matter to all communities, because a great many places, like Maidstone, gathered their water from surface supplies which were not properly protected. What they wanted to ascertain was whether chemical analysis was a proper protection, or did it need bacteriological examination as well. The epidemic had happily passed away from their unfortunate town. The medical officer, in his last report, stated that they had not had a single case of death from typhoid or diarrhœa in the two hottest months of the year, and the death-rate had decreased to its usual excellent figure of about 12 per 1000 per annum. They were very grateful to the city of Birmingham and to other places for the great help afforded them in their dire distress.

Dr. P. Boobbyer (Nottingham) remarked that it was rather a large order to reply to all the points raised in the course of the discussion, and he was disposed to demur to the raising of many of them. His paper was only a small one, intended to start the discussion, and he could not hope in the twenty minutes allowed for its reading to go over all the ground that had been touched by the gentlemen who followed him. He could only bring out a few points affecting the question that had come within his own immediate experience, and time forbade that he should either go into the work of other people on the same subject or digress from the actual points he had set himself to impress upon the section. In reply to Dr. Cooper Pattin he explained that by a five-roomed house he meant one containing five rooms capable of being occupied as such. He did not reckon out-buildings or sculleries as apartments, simply the living room, the kitchen beyond, and say three bedrooms. As to pail-closets, he pointed out that these were much abused, the pails leaked, and the surface of the soil became polluted by that means. Again, in the process of carrying the pail from the closet to the cart, spilling often took place along the route. As to Dr. Eustace Hill's remarks upon the danger of emptying midden-privies, this was exactly the thing he had laid most stress upon. It was the emptying which caused the major part of the pollution of the surface of the soil. He had seen many tons of stuff lying about upon the surface of back yards, lying there perhaps for half a day between the time the men emptied the privy and the time the cart came to fetch the contents away. Within the last fifteen years in Nottingham they had had two men suffocated in one of these pits while engaged in emptying it. Dr. Scurfield had spoken of the privy contents being temporarily deposited in the streets. To this he should not greatly demur (so long as these filthy receptacles remained), if the streets were paved with concrete or other impervious material. It was the emptying upon the naked and dirty soil which constituted the greatest danger. They were bound to have a nuisance in connection with the scavenging of midden-privies. That was one of the strongest objections to them. The process was disgusting to everyone, and was necessarily injurious to health. As to special pails for houses in which typhoid and other infectious cases were nursed, he thought they all used special pails now. At Nottingham they used a special pail with spring lid for every house at which a case of typhoid was notified, but the case was probably not notified until well on in the second week, and during all the previous time the excreta from the patient would have gone into the privy or closet-pail. That was an instance where the simple scheme of providing special pails was at fault. Then he came to General Phelps; to whom he pointed out that the typhoid at Nottingham was not confined to any soil or level. They had, on occasion, quite as thick patches on the very high ground, 400 ft. above the sea, as they had at the lower end of the town. On the outskirts of Nottingham, beyond the Trent, there was practically no typhoid at all, although there was a very fluctuating sub-soil water. With respect to the possible conveyance of typhoid fever by vaccination, he

CITY HOSPITAL, NEWCASTLE-UPON-TYNE, STERILISING CHAMBER.

PITAL, NEWCASTLE-UPON-TYNE, STERILISING CHAMBER.

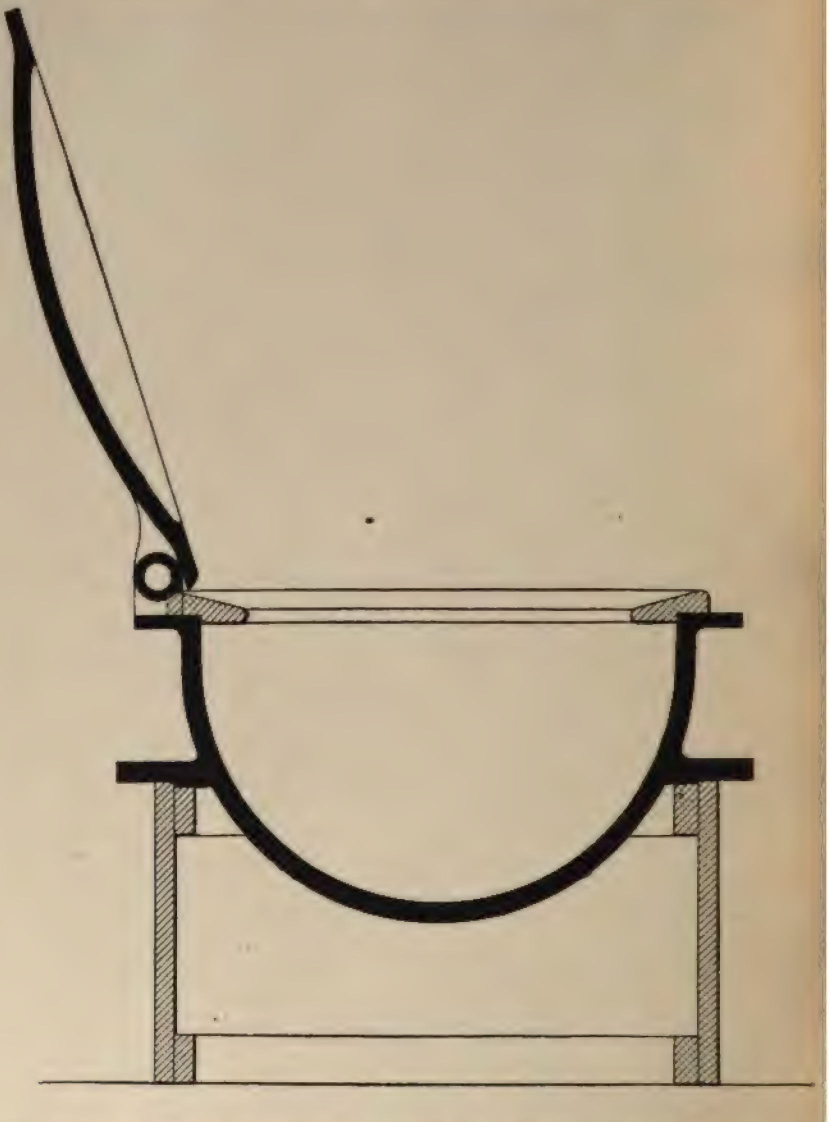


'or Bed Pans.
.
.

to Steriliser.
for Ejecting.
'ipe.
et.
sure Gauge.

L Water Pipe to supply Flush Tank.
M Water Main.
N 4-inch Discharge Pipe.
P 4-inch Inlet Ventilator carried down below Flush Tank.
Q 5-inch Outlet Ventilator.
R Ball-Cock to supply Flush Tank.
S 4-inch Siphon.
T 2-inch Waste Pipe to Flush Tank.
V Ventilator in Ceiling.

THE "NEWCASTLE" HOUSEHOLD EXCRETA STERILISER.



The Drawing shows the Steriliser placed on Wooden Stand for use, with a movable Wooden Seat, which is removed before the lid is closed.

THE "NEWCASTLE" HOUSEHOLD EXCRETA STERILISER.

Scale—1½ inches to a foot.

A Steriliser.

B Hinged Lid.

C Winged Nuts to tighten lid.

D Rubber Joint.

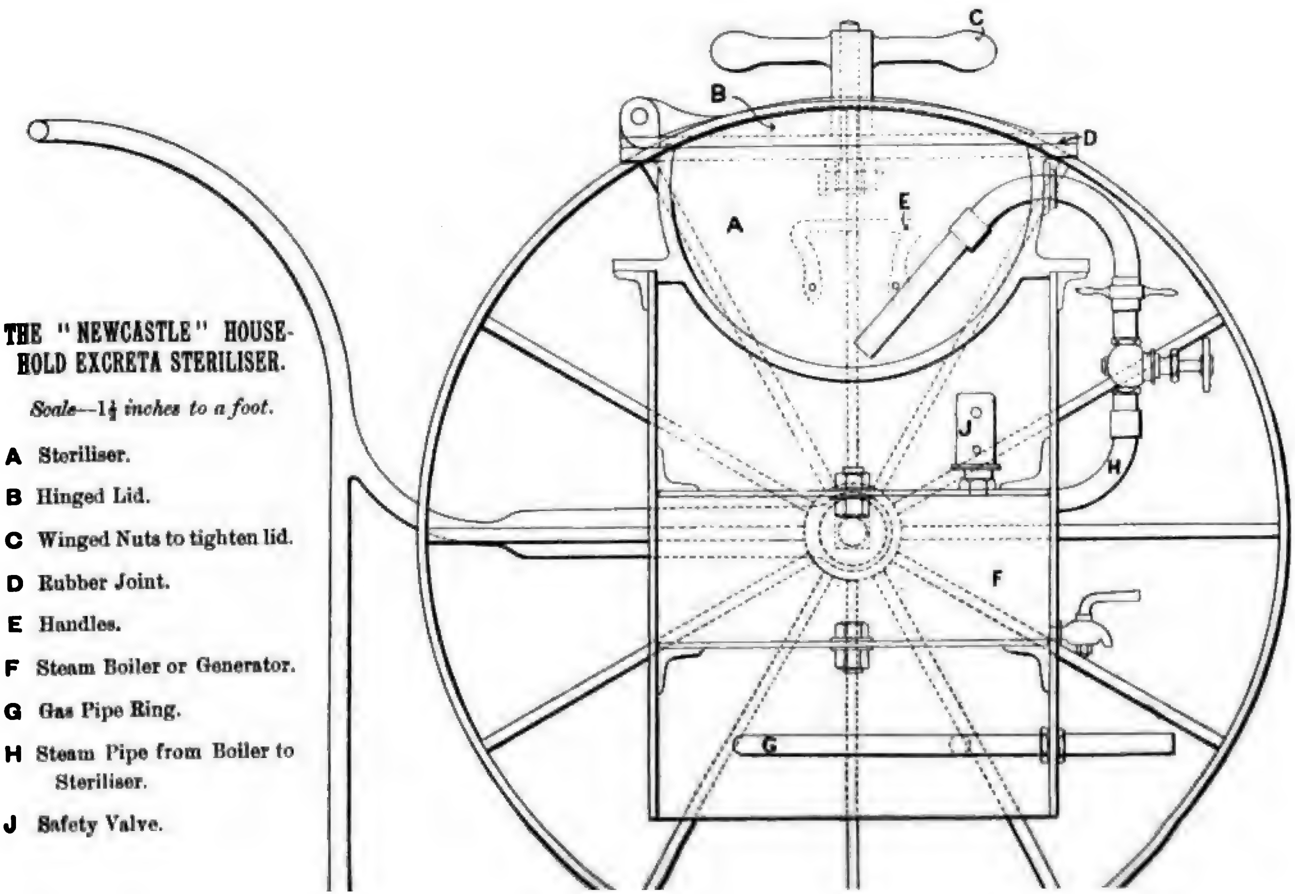
E Handles.

F Steam Boiler or Generator.

G Gas Pipe Ring.

H Steam Pipe from Boiler to Steriliser.

J Safety Valve.



might point out that in the majority of their cases this would involve the hypothesis that there had been an incubation period of at least twenty years. He was glad Dr. Porter supported his views, having had an experience similar to his own. As to leaky drains; almost all old drains were such. In his experience, the ordinary drain had a life as a water-tight tube of about three years only at the outside. Dr. Porter spoke of disinfecting the privies. He should like to know how the disinfection of privies could be done. He could not conceive any method of disinfecting the contents of privies, as they knew them. He had devised various means of preventing people from using them, putting in on one occasion, or at any rate having put in, sulphuric acid, which kept the people away from it for days. As to Dr. Clare's suggestion that they differentiate between the different classes of water-closets, he wished to make it clear that he had not distinguished them. Closets of all kinds worked by water were included as w.c.'s in his tables. He was somewhat surprised at the point raised by Dr. Sykes, because there were a hundred and one different ways by which the infected ejections from every orifice of the patient's body might reach the interiors of other persons. They had only to go among the denizens of ordinary town slums to realise how difficult it was to make them take the most elementary precautions. Let them go into the little rooms of one of these human kennels, and while there endeavour to realise what nursing at home meant for their inmates. To those who had had a similar experience to his own he did not think it was necessary to say more. It was almost impossible to hope that all that came from the patient in these circumstances would find its way outside the house, and if it remained inside there were a hundred and one different ways by which it might find access to the interiors of other persons in the house. He thought that in the vast majority of cases of typhoid moreover, even where they secured ultimate removal to the hospital, there would be a sufficient time elapsing between the onset and the time of removal for the infection of the privy, that is, if the house were furnished with a privy. He had had a considerable experience of colliers. According to his own account a coal-miner generally began his typhoid with a cold. Playing football perhaps he felt a shiver all down his back—but he would go on with his work or his play as long as he could stand. His case would not be notified until he was compelled by physical incapacity to take to his bed, and during all that period he would be capable of spreading infection. He did not think it was necessary to differentiate here between cases removed to hospital and cases remaining at home. Last year they had at Nottingham an undoubted falling off in typhoid. It occurred in the end of August too, just when they looked for the greatest increase (during the third quarter). This falling off was coincident with the opening of a ward block at the Isolation Hospital, for taking in those cases of typhoid occurring in the town which the General and Children's Hospital could not accommodate. They had exactly the same accommodation at the present time, and he was sorry to say the cases were now going up. This

was a typhoid year, and they were experiencing extreme difficulty in securing enough isolation space. Mr. Baker of Maidstone had raised a very simple question. It had often been said, and with self-evident truth, that it was of infinitely greater importance that the general surroundings of water supplies, and the means by which the water was delivered to houses, should be effectively inspected and safeguarded, than that the water should be submitted for analysis. He would put it like this:—it was surely much better and safer to exclude all sources of possible pollution, than to rely upon the analyst to discover dangerous impurities after they had reached the water.

"*The Disinfection of Excreta*," *by* Henry E. Armstrong, D.Hy., Medical Officer of Heath, Newcastle-upon-Tyne.

(Fellow.)

It has long appeared to the author that our methods of dealing with the excreta of diseases known to be most readily communicable through the medium of alvine discharges is a weak point of preventive medicine.

In one class of ailment the surface of the body is disinfected with the most scrupulous care and prolonged attention. In another the respiratory passages are treated in like manner. The segregation of the sick in all infectious diseases is practised wherever the nature of these diseases is understood. So highly is this mode of preventive treatment valued in one malady, smallpox, that hospitals for its isolation are required by the authorities to be located at a distance of half a mile from human habitations. Infected rooms and clothing, bedding, &c., exposed to infection are each rendered safe by special modes of treatment.

Are we equally careful and certain in our disinfection of the bowel discharges in cholera and enteric fever? In these diseases—whether treated at home or in the hospital—the evacuations, from their offensiveness, are liable to summary treatment. So long as the patient is in bed they are generally voided into a bed-pan containing more or less of some disinfectant solution. More disinfectant is perhaps added and the contents of the pan are thrown down the closet or slop-sink or buried in the ground as quickly as possible. The proportion of disinfectant used in such cases is seldom sufficient. If, for instance, the agent used be perchloride of mercury, a fluid ounce

or two of a 1 in 500 solution to, say, 1 lb. of stool is generally considered ample, whereas the evacuation itself requires for its proper disinfection one-five-hundredth its weight, *i.e.*, 76·80 grains of the dry perchloride, or 500 times the amount of solution (*i.e.*, about 4 pints). The excreta and the disinfectant must of necessity be intimately mixed if the disinfection is to be perfect. But who can rely on this being done, even when the evacuation is liquid? In the solid state such mixture is not to be expected, being indeed hardly practicable. The rinsings of soiled linen, &c., at the slop-sink require disinfection equally with the discharges caught in the bed-pan. But they are too often sent direct into the drain with a flush of disinfectant thrown in after to overtake them as it may.

The infected dejecta of convalescents from either of the diseases in question are commonly voided down the water-closet often without even the pretence of disinfection.

Burning the discharges after mixture with sawdust cannot be considered free from danger.

The quickest, safest, most thorough, and most certain way to disinfect excreta is by boiling them under steam pressure, a method requiring special apparatus not hitherto available for domestic use. Sterilization of excreta by steam was practised in Hospital at St. Petersburg during the outbreak of cholera in 1894. The evacuations and other infected liquids from the different cholera pavilions were conveyed in pipes to a large general boiler, into which steam was turned after the lid had been closed and fixed. This process had the disadvantage of allowing the liquids to leave a pavilion for disinfection at a considerable distance, thus giving rise to continual infection and fouling of a large amount of pipe. This defect is avoided in the apparatus devised for the Cholera Hospital of the Corporation of Newcastle-upon-Tyne by their city engineer, Mr. W. Geo. Laws, and the author, in which a small sterilizer is provided for each ward. A model of the apparatus was shown in the Exhibition of the Congress of The Sanitary Institute at Liverpool, and a paper describing the sterilizer was read before the Congress of the British Medical Association at Newcastle in 1892 by Dr. C. U. Laws. The appliance having been found fairly to answer its purpose at the Cholera Hospital, others have lately been fixed in off-shoots of the enteric wards of the City Hospital for Infectious Diseases. A plan and photographs is given on p. 520, from which it will be observed that the sterilizer, a circular cast-iron vessel about two and a half feet in diameter and holding thirty gallons, stands on the floor of a chamber containing also a slop-sink for rinsing soiled linen, bed-pans, &c. The wastepipe from this sink is attached by a

swivel joint, so that it can be turned up when not in use. When turned down it conveys the slops into the sterilizer. The bed-pans from the wards are emptied into the sterilizer, the inlet to which is provided with a movable wooden rim to allow of its also being used as a closet by convalescent patients. When the container is about three parts full, the lid is closed and screwed down and steam is turned on. Disinfection is completed in about twenty minutes, after which the contents are ejected by steam up the discharge-pipe and into the tank at the outside of the building, there to cool before going to the drain. After each operation the sterilizer is washed out by means of a three-quarter inch water pipe, the dirty water being also driven into the cooling tank by the steam ejector.

The chamber for the apparatus is shelved for bed-pans, urinals, &c., and is provided with an opening in an outer wall beneath which is a truck for the reception of linen which has been rinsed at the sink.

The foregoing observations refer only to the sterilization of the discharges of patients in hospital. But the necessity for similar disinfection in cases under treatment at home is quite as great as in hospital. In private houses, and still more so in tenement dwellings, the night-soil and slops are apt to be thrown into the ashpit or down the sink without the addition of a disinfectant. The soiled linen is frequently left lying for days before it is purified. In a household of ten persons, six of whom are at present in hospital at Newcastle with enteric fever, the spread of infection was due to the neglect of instructions to disinfect and purify the bed-clothing.

To prevent the danger from these causes, special arrangements for disinfecting the excreta and slops from cases of enteric fever, &c., not removed to hospital are required. This object may be effected either (1) by receiving the discharges into air-tight vessels and removing them daily to a sterilizing station for treatment; or (2) by sterilizing them on the premises where they are produced. As in the hospital the nearer the sterilizer to the ward the better, so, *primâ facie*, in private practice, sterilization on the spot appears preferable to that of removal for treatment at some distance, however small. In this view the idea of a Household Sterilizer first suggested itself, and the writer accordingly applied to Messrs. Goddard, Massey & Warner, of Nottingham, the makers of the Hospital Sterilizer, for plans for a portable apparatus for use on private premises, to be worked by an official of the local authority. A capacity of two gallons was thought sufficient, and lightness of weight for convenience of transport was a desideratum. It was proposed that steam should be generated by means of a coal fire or a ring of

gas-burners beneath the receiver. The appliance was to be provided with a seat for the use of convalescents and suitable means for tilting and discharge of contents into a drain. The design shown on p. 520 has been prepared by Mr. Warner on the foregoing lines.

The impracticability of heating by means of gas in tenement premises, and the length of time required to generate steam may be difficulties in the way of the satisfactory general working of this appliance. These objections are avoided if the liquids to be disinfected are removed to a central sterilizer, a proposal suggested by Mr. Laws and endorsed by the author. An ordinary thirty gallon sterilizer, with small steam boiler, cooling tank, &c., will probably be enough for the requirements of a district of half a mile radius. The number of such stations will, of course, depend on the area of the town. The infected liquids may be received into tin canisters with hermetically closing lids, and removed daily for disinfection. In cases beyond the radius, or when found preferable for other reasons, the portable household sterilizer should be useful.

Mr. T. J. Perry (Camberwell) asked whether the principle Dr. Armstrong had enunciated had been adopted for the whole of Newcastle or only at the hospital of which he was medical superintendent. It occurred to him that where they had large cities to deal with, the erection of these innumerable places would be a source of considerable expense. He had thought that most medical gentlemen were aware of the fact that enteric fever cases were nursed in many towns in the general hospital. He did not say it was desirable that they should be so nursed, but it was within his personal knowledge that there were few exceptions against their being so nursed, and in many places they were not considered dangerous to the other patients in the hospital. He was not advocating the practice, because if they were to have notification of diseases and were going to carry that out in an efficient manner, it was absolutely essential they should have the cases isolated. However, he saw a difficulty in the matter, more especially in having portable machines going about a parish to deal with the excreta in private houses. They had not much difficulty in dealing with the disinfection of linen—this was simply taken to the public disinfector, but he could quite see there would be objection in many cases to this apparatus going through the town to the homes of the patients.

Lieut.-General Phelps (Birmingham) said that as regarded the treatment of enteric fever in general hospitals, he should like to appeal to Dr. Hollinshead, because in the previous week they dis-

charged cured, from the Selly Oak Infirmary, two enteric fever patients, and as far as he was aware no evil result took place as regarded the other patients in the hospital. Dr. Hollinshead, he thought, would tell them that similar cases were treated at the hospital without the slightest danger to the other patients.

Dr. P. Boobbyer (Nottingham) complimented Dr. Armstrong upon his able advocacy of such an excellent thing as the disinfection of excreta. No one, he thought, could doubt for a moment the desirability of disinfecting infected excreta. The only doubt he had was as to the practicability of carrying it out, and he must say, with all due respect to Dr. Armstrong's long experience and great knowledge of public health subjects, he was afraid it was outside the range of practical application in most towns. So far as his own experience went, this was his definite opinion. At Nottingham they had for many years practised the disinfection of typhoid stools at the hospitals, and in private houses when the cases were nursed at home, by putting sawdust saturated with a strong solution of perchloride of mercury—1 in 1,000 or 1 in 500—into the special pails provided. They then took the foul sawdust and burned it. This was their whole practice in the matter. With reference to the probability of conveying infection by means of sewage, he should like to say that the sewage farm at Nottingham, which was situated at a distance of six miles from the town, received over a large flat of new-red-sandstone marl practically all the sewage of Nottingham. The General Hospital, the Isolation Hospital, and all the infected houses in the town ultimately sent their sewage to the farm. They had a very large staff of men looking after the farm, which was now over 1,000 acres in area, and in the course of ten years they had had only three cases of typhoid among the men employed on the farm, or labourers incidentally drafted from the neighbouring villages. In addition to these they had had one case of diphtheria and several of scarlet fever; but they could leave these out of consideration. One word as to the practice of nursing typhoid fever in general hospitals. Nobody was more strongly opposed to it than he was himself. He had spoken of it in season and out of season, and reported upon it until he was tired of reporting; but as yet had not succeeded in inducing the people responsible for it to give it up. General hospitals like theirs at Nottingham, which had the teaching of students in view as well as the nursing of the sick, liked to have a typhoid ward. It should also be borne in mind that at Nottingham the General Hospital and the Children's Hospital had isolation blocks situated at a considerable distance from the main part of the hospital, and connected with it only by a long covered way. He believed also that so far as the staff employed was concerned this was isolated too. The Isolation Hospital took only overflow cases, that was, cases which the General and Children's Hospitals could not accommodate.

Dr. Hollinshead (Birmingham) said it was quite true that he had had under his care two cases treated in the Selly Oak Infirmary, and

he had always been taught from his student days that there was no harm in treating such cases in general hospitals, provided care was taken in dealing with the excreta. The two cases he had referred to were in separate wards, but under the general nursing staff. Certainly no harm had come from it. Of course he quite agreed with every precaution being taken in accordance with what Dr. Boobbyer had said, and every precaution was taken in this instance. They lived and learned and he imagined the remarks that had been made in reference to the disease of typhoid would lead them to be even more careful in the future than they had been in the past.

Dr. WILLIAMS (Flint) enquired as to the strength of the solution that should be used to disinfect the stool. He had been taught to regard typhoid as only dangerous from the stool, but he was afraid that now they must regard it as capable of being propagated through different channels. In country places the conditions differed considerably from those existing in towns, and he was afraid Dr. Armstrong's suggestions would be impracticable in many instances on account of the expense involved.

Dr. J. F. J. SYKES (St. Pancras) said they knew that the conditions differed, and in reply to the last speaker he would endeavour to point a moral by telling a little story. Some years ago there was a district where an immense quantity of rubbish from London was being shot, and just at that time the idea had been launched that probably the London refuse was the cause of diphtheria in many of the districts distant from London that were receiving this refuse. A medical officer was asked to go down to see these places, and he went down. After walking about and being absolutely tired out with inspecting quantities of the refuse, he asked where the houses were, whose inmates were supposed to be injured by the refuse. There was not a house visible, and none within a mile.

Dr. GARRETT (Cheltenham) said there could be no doubt it was best that typhoid fever cases should be treated in hospitals specially intended for their reception and treatment. In the first place they had in the hospital special nursing, nurses particularly trained to take charge of typhoid cases. This was not always the case in the general hospital. Consequently he should say that the chances of recovery were greater in the special hospital for this one reason. Then as regarded disinfection of the excreta, etc., it might be stated as a general matter that in special typhoid hospitals the stools were much more likely to be well disinfected than in general hospitals where typhoid cases were received in a casual way, put in the general wards along with other cases, and attended to casually by nurses, who at one and the same time had patients suffering from typhoid and various other diseases under their charge. As a lamentable instance in regard to the treatment of typhoid cases in general hospitals, he mentioned the case of the University College Hospital,

London, where, some two years ago, a part of the water supply of the hospital became infected by the infection from the typhoid cases treated there, with the result that there was a small epidemic of typhoid amongst the nurses.

Dr. EUSTACE HILL (Durham) whilst agreeing that Dr. Armstrong's suggestions were of extreme value in regard to the treatment of specifically infected excreta at places like Newcastle-on-Tyne, was nevertheless of opinion that in regard to small urban and rural districts, they were at present out of the range of practical application This did not, of course, detract from the value of the suggestions in special cases. Undoubtedly a valuable precaution against the spread of enteric fever was to supply covered pails containing disinfectants for the reception of the excreta of typhoid patients. In the county of Durham it had been the practice for some time in certain districts to supply pails containing a solution of perchloride of mercury or carbolic acid to all houses from which cases of enteric fever were reported, and in everyone of these districts the medical officer of health had been able to say that there had been a marked decrease in the prevalence of enteric fever, the improvement in each case being attributed to the use of the pails. They were taken away and the contents disposed of by the local authorities. He was sure that this system of disinfecting the excreta of typhoid patients would be found to work well in small districts.

Dr. WILLIAMS (Flint) remarked that he had these pails in his own town, asked how often it was advisable to remove them.

Dr. EUSTACE HILL replied that in Durham the pails were removed every two or three days in some cases, and in others only once a week. In every instance where the pails had been supplied, the general result had been a reduction of the enteric fever prevalence and mortality.

Dr. H. E. ARMSTRONG (Newcastle), replying to the points raised, said the gospel was preached to the Jews and they did not receive it, and he did not think any the worse of some of the speakers because they had not received some of his remarks, and he thought that the word gospel was not at all inapplicable to the sterilisation of excreta. Dr. Eustace Hill had spoken of the impractibility of the principle advocated, but if it was possible to remove pails of excreta through the streets of towns, it was equally practicable to transport them in sealed vessels such as he recommended. This could be done cheaply, because the vessel, even if it were destroyed after use, did not cost much. In reply to Mr. Perry's remark that hitherto the principle had only been applied at the hospital at Newcastle, he could say there was nothing to prevent its application elsewhere. As to the question of the nursing of typhoid cases in general hospitals, he was glad that Dr. Garrett had given an answer. The epidemic at the University College Hospital, London, told its own tale, and the teachers of any medical school who allowed the possibility of that kind of thing were

culpable. He thought it was an admission of the want of organisation at Nottingham to say that the Nottinghan Hospital for Infectious Diseases received only the *overflow* cases of enteric fever from the General Hospital. Nottingham, they had been told, was a town where fever was prevalent, and attributed to the pail system. Dr. Eustace Hill had told them of the pail system being in vogue in Durham, and he had also said there was not a worse county than Durham for enteric fever. What was the cause of this? Dr. Hill's own story answered the question. He (the speaker) had read his paper for the purpose of showing the way out of a difficulty which no amount of sawdust and no amount of perchloride of mercury slopped on the top of infected dejection would meet. Replying to the question as to the strength of the solution of perchloride of mercury to be applied to the excreta, he recommended no strength at all. He did not believe in perchloride of mercury for that particular purpose. The removal of the excreta and receptacles should take place daily. Hermetically sealed tins could be obtained in any size according to the requirements of different houses. The scheme he advocated had been brought forth quite recently and was not in practical use yet. He did not think expense could reasonably be urged as an objection to it. The cost of the necessary building and plant would not amount to more than £150. The price of a steriliser itself is £30.

"*On the Work of the St. John Ambulance Association,*" *by* Surgeon-Major GEORGE A. HUTTON, J.P., Organising Commissioner of the Association.

ABSTRACT.

IN this paper Surgeon-Major Hutton showed the importance of a good ambulance service for the whole country; not only for our large cities and towns, but also for our villages and country districts as well. He quoted statistics of the ambulance service in several places, Birkenhead, Northampton, Halifax, and the Isle of Wight; and gave the opinion of Sir James Paget on the need for a good ambulance service everywhere. Sir James said, in a speech at the International Health Exhibition in London, in July, 1884, "As surgeon to a large hospital he had certainly seen the need there was for a better transfer of patients, whether sick or wounded, into the hospital wards. The patients in large hospitals were brought from the narrowest streets and the most distant villages, and from every part of the country, and it needed the enterprise and co-operation shown in a society like the St. John Ambulance Association to be able to take in hand a work of which the

design would be, as they had developed it, to spread the system of ambulance far and wide to every village in the kingdom, and to bring the knowledge of its utility and its application within the range of the whole community."

Surgeon-Major Hutton then gave a remarkable instance of the value of first aid, and careful removal. On 29th January last there was a terrible accident at Walkergate, about two miles from Newcastle-on-Tyne. No less than 110 persons were more or less seriously injured in an explosion of a tank of creosote oil containing some thousands of gallons, and close to the side of the North-Eastern Railway. Fortunately the railway men had been instructed in first aid and ambulance work, and thus knew what to do, and what was better proceeded to do it promptly and without flurry. Twenty-four of the most seriously injured were carefully moved in guards' vans by special train to Newcastle, and the Royal Infirmary being close to the Central Station were quickly placed there. The station-master informed me that the explosion took place at 4.58 p.m. and the injured arrived at Newcastle at 5.35. The *Newcastle Chronicle* said "it was one of the most noteworthy examples that have occurred in this neighbourhood of the advantages of ambulance instruction, and the facilities offered in this direction are not appreciated as they ought to be."

Surgeon-Major Hutton next alluded to the instruction in Home Nursing, under the St. John Ambulance Association, and clearly showed the great advantages of this instruction, as an adjunct and help to the District and Queen's Jubilee Nurses. What is one paid nurse in a district of some 5000 persons, and a number of sick? her services to each sick individual can only be very transitory, and her visits of short duration, and perhaps many cases want continuous attention both day and night. Here then the instruction afforded by the St. John Ambulance Association comes in, and by its means the mothers, sisters, wives, and daughters of the very classes most in need of this service, are taught what to do in the sick room—"home nursing."

Lastly, Surgeon-Major Hutton directed the attention of the Congress to the recently introduced course of instruction on *Home Hygiene* by the St. John Ambulance Association. By this course of instruction it is hoped to establish classes on similar lines to the first aid and nursing classes, so as to diffuse a practical knowledge of sanitary science and the laws of health, which will enable those acquiring it to keep their bodies and homes in a healthy condition, thereby tending to check the occurrence and spread of disease. It is hoped to carry the classes not only into our large cities and towns, but also what

is most desirable, into our villages and among our rural population generally. Within the last few years local government in counties had entered upon new lines, and we now have County Councils, and District and Parish Councils, and it is thought that by means of instruction in Home Hygiene, a better knowledge of sanitary matters would be diffused, both among these public bodies, and the rural population.

The St. John Ambulance Association confidently looks forward by means of its wide and extensive organization all over the country, to follow out this Home Hygiene instruction on the lines laid down by Sir James Paget when speaking at the International Health Exhibition in London in 1884, on first aid and ambulance work, viz., to spread the system of *Home Hygiene* far and wide, to every village in the kingdom, and to bring the knowledge of its utility and its application within the range of the whole community.

"*Suggestions for the Improvement of Milk Supplies*," *by* H. SCURFIELD, M.D., M.O.H. Sunderland.

(MEMBER.)

As regards improvement in our milk supplies there are two questions to be considered, one being an improvement in the quality of the milk as regards the percentage of fat and non-fatty solids contained in it, and the other an improvement in the means taken to preserve milk on its way to the consumer from contamination with dirt or the contagium of any of the infectious diseases.

As regards the first question, I will only say that it seems very desirable that the Somerset House Analytical Authorities should adopt a higher standard for genuine milk, as there can be no doubt that the present low standard of 2·75 per cent. for fat and 8·5 per cent. for non-fatty solids, allows a large amount of adulteration to go on unchecked. It is, I think, unreasonable, to fix the standard for genuine milk at this low water mark simply because an occasional cow occasionally gives milk of this description. A cow which habitually gives such milk ought to be fattened for the butcher, and if the milk of a number of cows mixed is equal in poverty to the Somerset House Standard it can only be because they are not properly fed. As an example of poor milk from poor feeding, it is, I believe, well

recognized that an excess of brewers' grains in the cow's diet produces watery milk. The result is the same for the consumer whether the water is added before or after the cow is milked.

In Amsterdam, Professor Saltet states that a great improvement has been effected in milk by the annual publication of the results of the analyses of the milk supplied by the different dairy companies, a competition having resulted as to who should head the list with the best quality of milk. I do not know whether such a system could be inaugurated in England.

At any rate I think that the Somerset House standard for milk fat should be raised to at least 3·25 per cent.

In order to protect the dairy farmer from an unmerited conviction for actual adulteration by the adoption of this higher standard, it might be made permissible for him to have the cows milked and a sample taken in the presence of the inspector, and then if the sample so taken corresponded with the original sample on which the proceedings were founded, this might be considered a valid defence as regards actual adulteration. The publicity of the proceedings would probably be sufficient punishment for poor feeding.

The second question, of the protection of milk from dirt and infection, is even more important than the first. It is apt to be forgotten that milk was intended by nature to pass from the teat of the cow to the mouth of the calf direct, without the chance of being exposed to any source of contamination. Most people are familiar with the deposit of dirt that settles at the bottom of a milk bowl when the milk is allowed to stand.

These bottles which I show contain material that has been separated from milk by filtration through gravel, and were obtained from the Copenhagen Milk Company. As there is a pharisaical tendency nowadays to think that dirty milk only comes from abroad, I produce these boxes which contain dirt that has been separated from English milk by the centrifugal separator used by the Farmers' and Cleveland Dairy Company. In addition to palpable dirt, the milk has to be protected from the contagia of the infectious diseases, and ought to be obtained from only healthy cows. Even if the precaution of boiling or sterilizing the milk is adopted, it is better to have cleaned boiled milk than dirty boiled milk; and milk which is boiled or sterilized after it has undergone fermentation changes induced by dirt which has found access to it is not the same thing as milk which has been properly protected against these changes up to the time of boiling or sterilizing. So many people, too, object to the taste of boiled milk, and I cannot say that I have tasted any sterilized or pasteurised milk that had not the taste of boiled milk.

There are many points with regard to the milk supply as to which fresh legislation is required.

Thus, in order to facilitate the rapid detection of a milk epidemic, every dairyman or purveyor of milk ought to be obliged to furnish the Medical Officer of Health of his district with a list of his customers when so desired. The Medical Officer of Health would then be in a position to notify the occurrence of a case of infectious disease on a dairy farm in his district to the Medical Officers of Health of districts supplied by such dairy farm.

Similarly a purveyor of milk ought to be obliged to furnish information as to the source of his milk, when so desired.

Again, the 4th Section of the Infectious Diseases (Prevention) Act, should be so amended as to secure the prompt prohibition of the sale in any district of milk which is shown to be causing infectious disease.

It is to be hoped that the valuable report of the last Royal Commission on Tuberculosis, will lead to more stringent and more uniformly applied measures of milk control, to the prohibition of the sale of milk from animals obviously affected by tuberculosis, and to the gradual elimination of that disease from our herds by the judicious use of the tuberculin test.

In the meantime I wish to suggest that Local Authorities might prepare the soil, as it were, for this expected legislation by drawing up model regulations more far reaching than any that can be made under the Dairies, Cow-sheds, and Milk-shops Order, 1885, and issuing certificates to dairy farmers who comply with these regulations. The certificates could be issued both to farmers living in the district and to farmers who do not live in the district, but who supply the district. The public would then know where to obtain milk which they could drink with reasonable safety, even when unboiled, and the farmers would be able to get increased custom and a higher price for their milk by advertising the fact that they held the certificate. The Sunderland Health Committee have just issued such regulations, and I am glad to learn that two of the largest farmers in the neighbourhood are preparing to supply milk on these terms.

I will not weary you by reading the regulations, but simply say that they include in addition to rules to ensure cleanliness—

(1.) The keeping of a stock ascertained to be free from tuberculosis by means of a veterinary surgeon's examination, which is to include the application of the tuberculin test.

(2.) The provision of a dairy and place for washing the milk utensils cut off from direct communication with the house.

(3.) The provision and use of a refrigerator. This is un-

doubtedly one of the most important means of retarding changes in the milk and lessening the risk of causing diarrhœa and gastric disturbances in children.

(4.) The notification by the farmer of any case of infectious disease, including consumption, measles, and whooping cough occurring on his farm or among his employees.

[*For discussion on this paper see page* 554.]

"*On Tuberculous Meat and Milk*," *by* JAMES NIVEN, M.A., M.B. Cantab., Medical Officer of Health, Manchester.

(MEMBER.)

THE question of tuberculous meat and milk is now advancing from the position of preliminary inquiry to that of practical administration. There is, nevertheless, still much difference of opinion as to the extent of the harm inflicted by the consumption of tuberculous meat, and it may, therefore, be advisable to give a brief résumé of our knowledge on the subject.

We are now able to put aside heredity as playing any important part in the propagation of the disease, without denying that in a small proportion of cases the bacillus tuberculosis is directly transmitted. How, then, is the disease sustained, causing as it does about one-seventh of all deaths?

Both post mortem examination and general statistics go to show that, in general, infection occurs through the air-passages. Unfortunately we have no statistics to show in what proportion of instances infection takes place through the alimentary tract in man. It is true that the statistics of tabes mesenterica and allied conditions, such as scrofula, would appear to indicate that the ratio to cases of phthisis is by no means inconsiderable. But, as is generally admitted, the statistics are unreliable, and vary greatly, suggesting differences in teaching and so forth, which obscure the real differences, which no doubt exist. Such exact post mortem knowledge as we possess shows that the number of cases of tuberculosis increases rapidly with advancing months and years of life, a fact which alone suffices to show that such terms as tabes mesenterica in our mortality statistics have no definite significance.

What, then, are the means available for forming an estimate of the effect of tuberculous food in propagating the disease. In the first place, it is necessary to establish clearly that tuberculous meat and milk are capable of causing the corresponding

disease in man. Numerous experiments, intentional and other, have established beyond any possibility of doubt that guinea pigs, rabbits and kittens, calves, pigs, and other animals, fed with obviously tuberculous matter from oxen, or with milk from tuberculous udders, readily contract the disease. In fact, the Report of the Royal Commission on Tuberculosis published in 1895 shows that milk from tuberculous udders is virulently infective. That the bovine disease is communicable to man is proved by those cases in which the disease has been set up accidentally by inoculation, and in which the whole course of the disease could be followed, just as with intentional inoculation of the guinea pig. Moreover, the disease produced in rodents is identical, whether it be the effect of human or of bovine tuberculosis.

Further, a few isolated cases are on record, in which it seems difficult to doubt that abdominal tuberculosis has been started in children by the consumption of milk from cows known to be tuberculous.

There is, however, this difficulty in such cases, that the disease takes a considerable time to develope, and that, the sources of possible infection being numerous, it is difficult to be certain that we have got hold of the right one.

In the course of careful inquiries which I made into the sources of fatal cases of tuberculosis, I was able to show that one could broadly lay down the rule that healthy people do not contract phthisis except on prolonged and intimate exposure to sources of infection, which can generally be ascertained by careful search.

It is probable that the same thing applies to abdominal infection. Even supposing that a single virulent dose is able to produce the disease, it is necessary to find the tissues in a weakened condition, a requirement which demands, in general, repetition of the infecting process. If this be so a great increase of probability is given to the theory that we have actually found the source of infection in those instances in which persons, not otherwise known to be exposed to infection, have contracted abdominal tuberculosis while consuming milk which has been shown subsequently to have for a considerable period contained tubercle bacilli.

Supposing, now, that we have definitely established that a considerable amount of abdominal infection occurs, would that necessarily prove that the disease was due to tuberculous milk or tuberculous meat? By no means. It is probable that in a small proportion of instances abdominal infection is caused in tuberculous households by ingestion of tuberculous dust on the part of young children.

On the other hand, abdominal tuberculosis is so often found disjointed from other forms of tuberculosis that we are strongly led to suspect some source other than human infection. It must be admitted, however, that our actual knowledge with regard to the occurrence of primary abdominal tuberculosis is remarkably deficient. Indeed, with the exception of Dr. Woodhead's valuable contribution to the subject, I know of no continuous observation on the point of any magnitude. Dr. Woodhead's investigation, however, sufficiently proves how extensive abdominal infection must be.

No one who has not endeavoured to obtain direct post-mortem evidence as to the frequency of primary abdominal tuberculosis would believe the vagueness and absence of facts positive or negative which exists. Professor Delépine has shown how, even in fairly advanced cases the course of the disease can be tracked, and under his direction two instances have been found out of 13 children selected as not being tuberculous, who were shown to be suffering from tuberculous abdominal glands. But it seems almost impossible to get sufficient opportunities of post mortem examination in young children. Having failed in this absolutely, and in such a manner as to show that it was almost hopeless to look for direct assistance, it occurred to me that some light might be obtained by the examination of animals killed at the Abattoir on the question whether tuberculosis was acquired by the young animal by ingestion. I therefore requested Mr. King, the Chief Veterinary Surgeon of the Manchester Corporation to make a careful examination such as would elucidate this question, and being himself engaged at the time with the question of tuberculosis in animals he readily agreed to do so. Taking the animals as they came he arrived at the results given in the following table.

Table showing the incidence of Abdominal Tuberculosis in cattle of different ages slaughtered in the Manchester (Water Street) Abattoir, and not specially selected.

Number.		Number Tuberculous.	Condemned as Unfit for Food	Number in which Abdominal Organs only were affected.	Number in which both Abdominal and Thoracic Organs were affected.	Tuberculous Udders.
Cows	168	69 or 41 per cent.	11	19	23	2
Heifers	124	27 „ 22 „	3	19	4	...
Bullocks	75	12 „ 16 „	...	8	2	...
Bulls	8	2 „ 25 „	...	...	2	...
Calves	23	1 „ 4 „	...	...	...	...
Total	398	111	14	46	31	2

It will be seen that the results of this examination point to young animals being infected to a large extent by the ingestion of food, and in particular of milk; although it is very desirable that these observations should be extended. It is true that milk is not the only means by which a young animal could contract the disease. It might do so by licking up tuberculous matter in an infected byre. Although this is not likely to be the chief explanation of these figures, it is necessary to exclude such a possibility. There should be no difficulty in doing so, if trustworthy persons could be found who would feed calves kept in an infected byre, on boiled milk only. We should, in that way, be able to determine whether such occurrences were due to infected milk. If such were the case then boiling the milk ought to ensure young animals against contracting the disease, and the extent to which primary abdominal tuberculosis was developed would determine how far abdominal disease was conveyed in the byre apart from tuberculous milk.

The question of the conveyance of tuberculosis by meat from tuberculous animals is one of great difficulty. The experimental evidence goes to show that the muscle substance is very rarely capable of causing infection. On the other hand it is not very rare to discover in cases of so-called generalised tuberculosis tubercular nodules in the lymphatic glands embedded in the meat. It is certain that the ordinary processes of cooking do not suffice to ensure the destruction of the infective material in the deeper seated glands, and such meat must, therefore, be considered unfit for food, even when the muscle substance is not apparently injured. Under all circumstances crude tuberculous lesions must be regarded as dangerous, and the organs in which they occur must be condemned. With regard to the possibility of meat being smeared by the butcher with tuberculous matter owing to its being cut by a knife which has previously been in contact with tuberculous material, such a contingency is surely of no great moment except in the case of rolled meat, as even imperfect cooking would usually remove any effect of such smearing. With regard to the effect of tuberculous meat in producing abdominal tuberculosis, it is certain that the harm done in this manner cannot be very great, and is probably not comparable with that effected by milk from cows with tuberculous udders. There is, so far as I am aware, absolutely no direct evidence of the disease having been thus conveyed; yet, I do not think we should too readily accept the view that the disease is not so conveyed. Supposing tuberculosis to be in reality so kindled, it would take a considerable time to develope, and perhaps might never pass beyond the mesenteric glands. It would affect chiefly poor and

hard-worked people, who would be most likely to use tuberculous meat, and would certainly suffer most from its use. Such infection, if it led to a fatal result, might very well do so by inducing an explosion of miliary tuberculosis, which might be diagnosed as typhoid fever, and the cause of which, even if the disease were correctly diagnosed, would probably be overlooked; or, it might result in ordinary phthisis. It scarcely seems possible to doubt, considering the quantity of tuberculous and infective meat which we know is sold, and considering also the inefficiency of ordinary cooking as a disinfecting agent, that a certain amount of infection occurs in this manner. I do not put absolute confidence in the result of "post mortems." A few months ago while examining the carcase of an animal widely affected with tuberculosis, it seemed evident that the primary lesion had not been found, and on cutting into the mesentery large tuberculous masses, previously concealed by fat, were found which had in all probability been the starting point of the disease. It is often by no means difficult to overlook such occurrences, and we stand much in need of a special investigation on this point carried out carefully by a skilled pathologist on definite lines, such as those laid down by Professor Delépine.

The Royal Commission on tuberculosis, the Report of which was published in 1895, took up the position that the danger of infection from tuberculous milk is a serious one, while the danger from tuberculous meat, though not one to be entirely disregarded, is much slighter than the other.

It appears to me that there is some danger of the risk from both causes being at present somewhat under-rated. As regards meat, the amount of both flesh and organs actually containing tubercular infective matter is I believe under-stated, though I can give nothing in support of that view except a general impression. As regards milk, however, we have definite information.

Dr. E. W. Hope, of Liverpool, in a report on tuberculosis as affecting the milk supply of the City, states that 144 samples of milk from the city cowsheds, and 24 samples taken at the railway stations, were distributed to four bacteriologists of eminence. Of the former 2·1 and of the latter 29·1 per cent. were found to contain tubercular infective matter.

The milk from nineteen tuberculous cows in Manchester cowsheds, was sent to Professor Delépine who found, on examination, that five samples contained the tuberculous infection, all of them from tuberculous udders.

Since that investigation was made 93 samples of milk taken at random at Manchester railway stations have been submitted

for examination to Professor Delépine, and of these no fewer than 17, or over 18 per cent. contained tubercular infective matter. Now if it is true that milk is only virulent when derived from tuberculous udders then the farms from which these milks were derived ought to contain cows with tuberculous udders. Accordingly the Sanitary Committee of Manchester instructed Mr. King to request the farmers to permit him to examine their cows. Sixteen out of the seventeen farms were examined, and on fourteen of these at least one cow was found with an indurated udder. It thus appears that at present an enormous stream of infectious milk is pouring into our Cities, and that the matter is truly one of urgency.

Assuming, now, with the recent Royal Commissioners that the danger is a serious one, we have to consider in what ways it is to be encountered. Such a consideration involves other issues besides the protection of the public against the danger of being infected by tuberculous meat and milk, and these have to be duly weighed.

We may profitably consider first what are generally the directions in which action might be taken, then go on to discuss the recommendations recently issued by the Royal Commission, and finally deal with the action which we may profitably take in aid of those recommendations.

First as regards tuberculous meat it is desirable, with a view to allay the irritation which undoubtedly prevails, that a standard should be established in reference to tuberculous carcases as regards seizure. It is necessary on this point to remember that there seems to be a general agreement on the likelihood that the system of Freibank would not be successful in this country. In that case we cannot afford to be quite so lenient in our dealings with tuberculous carcases as our German neighbours. The next point which we have to consider is the urgency of some efficient system of meat inspection. No system can be efficient, and at the same time reasonably economical, which involves the retention of a large number of private slaughterhouses, or the employment of untrained and unskilled inspectors. The question of meat inspection is by no means purely a tuberculous one, and a sufficient measure of reform would be far reaching, both as regards the quality of meat, and the efforts made by farmers to protect their stock from disease.

As regards tuberculous milk, the protection of the public has to be viewed from two different standpoints—the direct exclusion from the market of infectious milk and the establishment of such circumstances of cowkeeping as will reduce the risk of disease in the cow, as well as of other conditions rendering milk infectious, to as small dimensions as possible.

There are at present no legal powers under which milk containing the infection of tuberculosis can be seized. Tuberculosis is, to begin with, not legally an infectious disease. It might be suggested that such milk could be seized—a measure which would undoubtedly have a good effect—under the Public Health Act, 1875. Unfortunately, however, the condition of the milk cannot generally be ascertained under a period of over a week.

On the other hand, not only can the diseased milk be discovered, but, as a large experience in Manchester has recently enabled us to assert with confidence, the cows, the tuberculous udders of which are doing the mischief, can be traced with certainty in nearly every instance, unless the cows have meantime been removed.

Here, then, we come at once upon the prime requisites of administration in a city or town supplied with milk from outside districts. When a milk is found by a sanitary authority to be tuberculous, they ought to possess the power of at once tracing the animal which is infecting the milk, and of arranging for the removal of the diseased cow.

As regards subsequent protection, when it has been shown that tuberculous milk is being sent in from an external farm, the local authority ought to have reasonable means of satisfaction that all dangerous conditions have been removed before the milk from the particular farm is re-admitted into their district.

Such action, however, though it might be useful as a palliative and a stimulus is insufficient in itself to deal with the danger arising from tuberculous milk. Two other steps are required, viz., to house and manage the cows in such a manner as to diminish as much as possible the risk of infection even when they are exposed to it, and to remove the risk of infection.

To remove the risk of infection is to eliminate tuberculosis from the herd. That this is a perfectly practicable proceeding is shown by Bang's experience in Denmark. The rationale of procedure is to ascertain by inoculation with tuberculin which animals are tuberculous, and to isolate these from the sound animals. This is not, as a rule, difficult to effect except where the accommodation for the cows is totally inadequate. The tuberculous cows are then fatted for slaughter, after, perhaps using those not in an advanced stage of the disease for breeding purposes.

Tuberculosis is a very expensive disease to the farmer. But he is generally not a capitalist, and is not in a position to clear out all his tuberculous stock at once. It is, therefore, desirable to give him every encouragement to effect so desirable an object.

At the same time, to continue the exclusion of tuberculous animals will require care, skill, and knowledge, and we are thus led to consider the difficulties attendant on the housing of cows as well as on carrying out the elimination of tuberculous cows. At the present time much of the milk that comes into towns is not only diseased but dirty. In that way two classes of infection are introduced, the infection of tuberculosis and the class of infections of which summer diarrhœa is the most deadly. No measures which failed to deal with this great evil would be at all adequate, and moreover the precautions requisite to guard against the importation of diarrhœa are to a large extent the same as those required in dealing with tuberculosis.

The infection of tuberculosis spreads in the cowshed, and is chiefly communicated by dried tuberculous matter, which is partly extruded from the nostrils of tuberculous cows, partly discharged in the excreta. The filthy incrustations so often seen on milch cows must thus be regarded as a source of danger, both as regards tuberculosis and as regards summer diarrhœa.

That the infection is communicated in the cowshed is shown from the rarity of the disease amongst cattle not confined in sheds. Moreover, it must be largely contained in the lower stratum of the cowshed, otherwise the attendants would much more frequently contract the disease than they do.

From these considerations it follows that the first requisite in a cowshed is rigorous cleanliness, especially in the front part of the stall, and in respect of the removal of manure. The greatest care should also be exercised in keeping the cows scrupulously clean. The floor of the cowsheds should be constructed of some hard impermeable material, and should, whenever possible, be cleansed with water, especially about the head of the stalls, and in the back part of the stalls as well as behind the cows. The construction of the floor has been dealt with under a Report on the Manchester cowsheds. No attendant should be allowed to milk cows with dirty hands. The times of cleansing should be so arranged as to ensure the minimum of dust being present in the atmosphere during milking, although it would be still better to have a covered milking station outside the cowshed.

It is desirable that each cow should have a separate stall, the divisions being alternately 6 ft. and 4 ft. in length. Each cow should also have a separate feeding trough of earthenware, bedded in cement, whether the cows are separate or not.

Only second in importance are good ventilation and abundance of light. Good ventilation must be taken to include a sufficient floor space and cubic space, and I agree that 800 cubic feet per cow is certainly not too much to require in new cowsheds.

It is quite impossible to secure adequate ventilation without

injurious draughts unless sufficient air space is secured. Cows are kept cooped up in a small confined space which becomes intolerably close and warm, and directly the door is opened they catch cold. Under such conditions a very little infective matter in the cowshed is sufficient to set up tuberculosis. Here again, is another reason why the attendants escape so often, while the disease spreads amongst the cows.

In some parts of Lincolnshire the cows are never confined at all, though open sheds are provided for them to shelter in. Under such conditions tuberculosis is rare. It is probable that they require more food to give the same amount of milk as cows which are kept in close sheds. On the other hand there is not the loss which arises from the spread of tuberculosis.

It is possible however, to find the just mean, so that air is admitted to, and extracted from the cowshed in such amounts, and in such a manner as to maintain a proper equable temperature, while avoiding injurious draughts.

For that purpose air may be admitted by sufficient space under the eaves and extracted by openings along the ridge of the roof if the cowsheds have not got the hay-loft over them, as they ought not to have. If they have, numerous openings should be made in the walls at a height of say 6 ft. and at ceiling level. The object to be aimed at is even diffusion of the circulating air with, if possible, some motive power, which is secured by lofty cowsheds having no hay-loft over them, and may still further be attained by extraction cowls.

Abundance of light is requisite in order to ensure cleanliness. If apprehensions—which I believe to be groundless—are entertained that the health of the cows or their milk production will suffer from the cold experienced where there is sufficient window area, two things may be pointed out. First this consequence does not, as far as I am aware, actually ensue where abundant light is provided as in cowsheds which I have seen both in Denmark and in this country. Secondly the supposed injury can be effectually guarded against by making the lower and larger portion of the window fixed and double, the smaller upper part being a hinged sash.

In addition, all cows should be systematically inspected at intervals not exceeding three months; if cleared of tuberculosis then every six months; or, if disease is known to be present in the cowshed, every fortnight. To sum up, the requisites of successful administration as regards tuberculous meat and milk may be thus stated.

Efficient inspection and regulation of the meat market and the exclusion from consumption of tuberculous milk, which may be taken to imply adequate measures for ascertaining when

tuberculous milk is being imported, and power to deal with such milk, as well as to ensure the removal of the cows producing it.

Every assistance possible should also be given to farmers to get rid of tuberculous cows from their stock. When the herd has once been freed from the disease, comparatively little trouble will be necessary to maintain immunity, and the result will assuredly be a saving to the cowkeeper.

Uniform regulations should be in force under the Cowsheds, Milkshops and Dairies Order of 1885, or under fresh legislation dealing with the condition of cowsheds, the maintenance of cleanliness, utensils, the storage, preservation and conveyance of milk, and providing as far as possible for the efficient carrying out of the regulations. Systematic inspection of cows should be maintained, and local authorities should have power to remove cows having tuberculous udders, or suffering from a severe form of tuberculosis. Comparative efficiency in administration might be attained in two ways.

By the creation of a Public Health Veterinary Service, responsible directly to County Councils, charged with the duty of inspecting cowsheds and cattle, supervising the application of tuberculin and giving instructions in its use, and generally carrying into effect legislation, having for its purpose the elimination of disease from herds and the protection of the milk supply.

It might very well be urged, however, that such a proposal implies very great expense, and that, moreover, especially in counties comprised chiefly of rural districts the veterinary officers of the county would not always find it easy to carry out their duties. I do not think either objection is a fatal one. If a resolute effort is to be made to cope with the imperfections of the milk supply, some such machinery will be necessary. There is an increasing tendency for farmers to utilise tuberculin with a view to the elimination of the disease, and there is little doubt that the movement will spread. In that case such a service is almost a necessity, both for the initiation of the requisite procedures, and for the subsequent maintenance of suitable conditions.

There is, however, another direction from which official pressure can be applied. It will be seen from the Manchester experience that not only can tuberculous milk be detected by a skilled bacteriologist, but the tuberculous udders from which the tuberculous milk has come can be found out by a competent veterinary surgeon. That being the case, sanitary authorities might have the power given to them to ascertain the actual source from which milk declared by a competent bacteriologist to be tuberculous has been derived, and to take effectual action

fully defined lines on which seizure should or should not be made, such as are provisionally put forward in the Report.

It is desirable on page 22, recommendation 6, *a*, *b*, *c*, and *d*, that the word "shall" should be substituted for the word "may;" otherwise we shall have the same trouble and want of uniformity as have been hitherto experienced.

As to the seizure of the whole pig, we shall all be agreed. As regards foreign dead meat, I consider that the thoracic and lumbar gland should in all cases be examined for generalised tuberculosis. With a little practice, this would be done rapidly. Further, any evidence of extensive removal of tuberculous masses would condemn the carcase.

Milk.—Diseases in the udders of cows.

Section 7 recommends compulsory notification of every disease in the udder—to whom is not stated.

Section 8 recommends that powers should be conferred on sanitary authorities similar to those contained in the Glasgow Police (Amendment) Act, 1890, which empowers the medical officer of health or sanitary inspector, or any one acting under their orders, to visit any cowshed and examine the cows at all reasonable times.

On intimation from the Police Commissioners that any animal in his cowshed is suffering from tuberculosis, or any disease which might render the milk dangerous or injurious to health, the cowkeeper must get rid of the animal; and if he retains it, renders himself liable to a penalty of £5.

The same power of inspection is extended to animals outside the city, but they have not yet been put in force.

Section 9 recommends that powers be given to take samples of milk sold in a district for analysis—bacteriological, it may be presumed. Such powers would be most valuable to urban communities, though they would not be a solution of the tuberculosis problem.

I have advocated the creation of a veterinary public health staff, which could best be made responsible to County Councils. Each member of the staff would have a veterinary district, and would make a systematic examination of cowsheds, cows and dairies, and water supplies. With the procedure as regards the health of the cows the veterinary surgeon would deal on his own reponsibility, subject to the County Council. As regards insanitary conditions of the cowsheds, dairies, and water supplies, he would report to the medical officer of health of the sanitary district, who would deal with the report, and would be required to report directly to the County Council as to the action taken. The veterinary surgeon would also report his action to the County Council. He would be the representative of the Local

Government Board in distributing tuberculin, and seeing that the necessary measures of isolation are carried out. He would either himself apply the test, or instruct local veterinary surgeons in its application. His salary would be defrayed by the County Council, and he would be independent of private practice.

Cowsheds, Byres, etc.

Section 10. The Commissioners recommend that the Local Government Board should be empowered to require local authorities to adopt regulations as to dairies, cowsheds, &c.

The County Council may usefully be charged with the duty of seeing that they are enforced after adoption.

Section 11 provides for the discontinuance of unsuitable shippons in urban districts, and would also prohibit the erection of new shippons within one hundred feet of a dwelling house.

Now there is this to be said about shippons in urban districts, as matters stand at present, that the cows in them are, so far as one can judge, less diseased than in country shippons. The chief reason for this is that cows in the country are kept for a number of years, while milch cows in the town are often kept only a brief period; and then slaughtered, or at all events shifted. In this way the risk of disseminating the disease to a serious extent is much less in towns than in the country, simply because tuberculosis has not time to develop. Naturally, the cowkeeper endeavours, in general, to procure good cows in buying fresh ones.

Further, there is less risk of fatal diarrhœa arising from town milk which is often distributed direct from the cow, than from milk which has been brought from a considerable distance.

Nevertheless, I consider that cowkeeping in towns should be restricted in the manner recommended by the Commission, and discouraged as far as possible, provided always that adequate security is obtained for the proper safeguarding of milk obtained from the country from disease, and from decomposition.

Section 12. The conditions to be attached to cowsheds registered in an urban district are excellent. I would only suggest that the depôt for manure should be defined as a structure with impermeable foundation and walls.

Section 13 is on the subject of ventilation in sparsely populated places. For the reasons already given, the sanitary requirements of country cowsheds need to be not less, but more strictly, enforced than those of towns.

Section 14 recommends that where cows housed in one

district supply milk to another district, the local authority of the district in which the cows are housed, shall be bound, when required, to supply to the local authority of the district in which the milk is sold or consumed, full information and veterinary reports regarding the condition of the cows, byres, etc., whence the milk is drawn. If the local authorities are not satisfied with the reports, they may apply to the Local Government Board with a view to an independent inspection and report being made.

On this important proposal I have this remark to make:—That the local authority should be empowered themselves to inspect the farms in the second place, else it is difficult to see how they could have sufficient grounds of dissatisfaction on which to make an application to the Local Government Board. However, the proposal contained in section 8 amply covers this difficulty.

F. Elimination of Bovine Tuberculosis.

The Commissioners recommend that funds be placed at the disposal of the Board of Agriculture to supply tuberculin and the services of a veterinary surgeon under certain conditions, which, taking everything into account, should be strictly enforced, at all events in the first instance. This is an excellent proposal.

It will be seen, then, that I regard the recommendations of the commission as most valuable, if not all that one wishes.

The chief directions in which I think they might be added to are:—

1. The creation of a veterinary public health service.
2. Greater facilities for inspection of outside cows and shippons, the milk from which is brought into a district. In particular, when the bacteriological examination of a milk supply shows it to be tuberculous, power should be given to the medical officer of health and veterinary surgeon, either jointly or separately, to go direct to the farm, inspect the cows and cowshed, and arrange for the removal of cows with diseased udders or otherwise badly diseased. This would, however, be met by section 8.
3. The notification of disease in an udder to be made not only to the authority in whose district the cow is, but also to the authority to whose district the milk is sent.
4. The standard of sanitary requirements to be, at least, as high for country as for town shippons.

I have at present a preliminary statement from Professor Delépine showing a number of milk samples examined at the

station to be tuberculous, some highly so. Examination of the cows by Mr. King has since revealed the presence of cows with indurated udders at fourteen out of seventeen incriminated farms. The action taken is, of course, *ultra vires*. These results cannot be utilised by the continued examination of the cows at the farms from which the milk is obtained. Much less can any action be founded on the results of inspection.

The Commissioners have rejected the principle of compensation for an animal seized on account of tuberculosis. I am disposed to think that compensation should be given in cases where it is clear that the animal could not have been diagnosed during life to be suffering from the disease. I would not compensate, however, but prosecute where a cow is kept supplying milk while suffering from advanced tuberculosis or from disease of the udder such as could not have escaped detection. The Commissioners practically recognise compensation when they recommend that a local authority should make a contribution to a Mutual Butchers' and Farmers' Insurance Fund. In my opinion an insurance fund is inadequate, in so far as it offers no inducement to a cowkeeper to get rid of a tuberculous cow at an early stage of the disease, which a judicious system of compensation would do.

Two of the recommendations of the Royal Commission are especially urgent, viz.:—

1. To place at the disposal of farmers facilities for carrying out the examination of their herds by tuberculin under certain conditions.

2. The giving of powers to local authorities similar to those contained in sections 24-27 of the Glasgow Police (Amendment) Act of 1892.

In view of the urgency of these proposals and of the great importance and value of the recommendations as a whole, I would propose that a resolution be passed that "*In the opinion of this meeting it is desirable that a Bill be introduced at the earliest possible date for giving effect to the recommendations of the Commission, particularly in respect of the last named proposal, and that an urgent appeal be made to the Minister of Agriculture to carry out the first proposal.*"

We may now ask ourselves whether we can do anything until the legislation which we desire arrives, or rather until we have obtained not only the legislation necessary but its enforcement, which is a different and more distant prospect.

You are all aware probably that, under the untiring and able management of Mr. Busck, an admirable milk supply is obtained for the city of Copenhagen. The principles on which the Copenhagen Milk Supply Association have established their

immense and successful business are those on which we wish to see our milk supply based. These are—

1. The milk is brought from well-managed farms where the strictest cleanliness is exacted in cowshed and cow.

2. The cows are frequently and regularly inspected by a staff of veterinary surgeons attached to the company.

3. Infectious disease is guarded against by a most liberal system of dealing with farmers and employees when infectious disease occurs in their families.

4. The taste and quality of the milk are ensured by prescribed and well considered modes of feeding the cows.

5. Injurious changes in the milk are averted by a well planned system of cooling the milk from the time it leaves the cow till it reaches the consumer.

6. Fraudulent tampering with the milk is guarded against by ingenious and effective precautions.

7. The utmost regime of cleanliness is exacted in all milk vessels, dairies, &c., while the milk is carefully filtered clear of all impurities.

The final article is thus rich, fragrant, clean, and free from danger.

An equally successful Company on the same lines exists at Berlin, and a similar company is being inaugurated in Manchester.

What can be done in Copenhagen can assuredly also be done in this country.

Then again all Public Institutions should require their milk to be from herds guaranteed free from tuberculosis and housed in clean, well arranged, well ventilated, and well lighted cowsheds.

In 1897 the supply of milk to the Monsall Fever Hospital, which contained at one time 500 patients, was obtained by the Sanitary Committee of the City of Manchester from such a herd, and the farm buildings were alterd to the requirements of the Local Authority. This farm is now supplying the Royal Infirmary.

The same policy had previously been carried out at Sunderland under the guidance of Dr. Scurfield.

This year the Monsall Fever Hospital has been supplied from a fresh source, which is again entailing considerable alterations.

Surely this is a policy which public institutions ought to pursue, and the Royal Infirmary of Manchester has shown its accustomed public spirit in leading the way amongst voluntary institutions.

A few owners of herds round Manchester have already eliminated tuberculosis from their stock, and undoubtedly their

lead will soon be followed. It would be easy to point to other instances of public spirit, and I would especially mention the excellent work initiated by Lord Vernon in the improvement of homesteads, and in the elimination of tuberculosis from herds on his estate.

The Duke of Westminster's improvements are familiar to all who have visited the country round Chester.

Lord Crewe and others are also credited with extensive improvements, though I cannot speak of these from personal knowledge.

Mr. John Speir has personally tested his cattle, and has, I understand, eliminated the unsound cattle.

Meantime it is surely not too much to expect that private enterprise will do much to disperse the difficulties attending administrative action. The course of action which we are advocating is assuredly to the ultimate benefit of farmers, and should receive their hearty adhesion. Only the first step is difficult, and means should be found to make it as easy as possible.

On one point I would venture on one or two remarks. The process of eliminating and excluding tuberculosis requires above all that farmers should possess isolation sheds or other means of isolation. Inasmuch as these would probably be for purposes of fattening only, it is not necessary that they should be so expensively constructed as buildings required to house milch cows. In any case it seems clear to me that the farmer cannot be expected to provide the necessary isolation sheds. In many instances isolation might be obtained by temporary movable partitions as has been done by Bang. This difficulty can, in no case, be regarded as insuperable, or even as serious.

We may, I think, usefully carry a resolution that all public institutions, hospitals, asylums and public services ought to obtain milk from herds guaranteed free from tuberculosis by a competent veterinary surgeon.

It follows almost as a necessity that, if measures are to be taken to ensure a pure milk supply from our home farmers, fresh foreign milk should be excluded from our markets, as was pointed out by Prof. Delépine in his address at Keswick, and more recently at Sudbury. Such milk could only be allowed to come in under adequate guarantees, and it is difficult to see how guarantees can be made adequate.

The question of imported butter is a difficult one. An effort should assuredly be made to ascertain that imported butter is derived from sound cows.

No less important than administrative effort is the work of educating the public to a due appreciation of the importance and the bearing of that new knowledge which the enormous

amount of research during the last sixteen years has brought to us. A gradual revolution in the attitude of the profession and of the public has been produced by the labours and the expositions of a great array of distinguished workers in this country, which includes such men as Burdon Sanderson, Watson Cheyne, Delépine, Woodhead, MacFadyean, Ransome, Thorne Thorne, Russell, Squire, Heron, and many others, whom it would take too long to enumerate.

The education of the people, a humbler but necessary task, has been carried out most systematically, perhaps, in Manchester, Oldham, and Glasgow. This movement began in Manchester, I believe, under the auspices of the Manchester and Salford Sanitary Association, guided by Dr. Ransome, with the distribution of leaflets in connection with the Consumption Hospital. An independent movement arose about the same time in Oldham, where in 1888 the sanitary authority caused leaflets to be distributed to every house in the town, containing simple precautionary instructions, and laying stress on the necessity of boiling all milk before consumption.

In Manchester on three successive occasions the Sanitary Authority have caused preventive instructions to be sent to every house.

More recently Glasgow has carried out a similar educational work.

Such educational work is a necessary preliminary to legislative action. However important it may be to have sound legislation on a question of this importance, and however clear the necessity and scope of such legislation may be, it is useless to promote legislation which is adverse to many prejudices, and which at all events appears to run counter to large and important interests, unless public opinion has been educated to the point not only of accepting such legislation, but of insisting on its being carried into effect.

This work of education, on which many Medical Officers of Health, among whom I will only mention Dr. Russell and Dr. Chalmers of Glagow, Dr. Francis Vacher, Dr. Jasper Anderson, Dr. Scurfield, Dr. Hope, Dr. Brown of Carlisle, Mr. Shirley Murphy, Mr. Charles Paget, and Dr. Newsholme, have bestowed much careful work, is at the present time one of increasing importance, and we must therefore wish all success to the new society for the prevention of phthisis, in whose programme this educational work figures very largely. It is also a pleasing sign of the times to find that the County of Durham have taken up this work, doubtless as a preliminary to practical action.

Amongst the useful instructions which have been issued in

this country, I would especially select that which was issued by the North Western Branch of the Society of Medical Officers of Health, and which was prepared by Mr. Charles Paget, now Medical Officer of Health for Northamptonshire, and leaflets drawn up by Dr. Francis Vacher of the County of Chester, and Dr. Jasper Anderson, of Blackpool, respectively.

One thing which I must protest against is the alarmist cry that by a plain statement of the facts about tuberculosis, people will be frightened into harsh and unnecessary action. Many years experience of education on a large scale on the part of the authorities of Manchester and Oldham enables me to say with confidence that such fears are chimerical, and that it is not too easy, but very much too difficult to excite even reasonable apprehensions.

From all these considerations it will be seen that we still require strenuous efforts to be made in investigation, education, legislation, and administration.

As regards investigation, we require a combined effort to extend and confirm such inquiries as those which Dr. Woodhead has made from the pathological, and those which Prof. Delépine especially has made from the experimental point of view, into the modes of infection, and more particularly into the extent to which abdominal infection actually prevails in man and in cattle under existing conditions.

With regard to education sanitary authorities may be expected more generally to instruct the public as to the modes in which they are liable to the infection of tubercle, and as to the measures of prevention which are necessary. Sanitary authorities will also exercise a powerful educational influence by the administrative action which they will take, and in this connection it is well to recognise the splendid work which is being carried on across the Atlantic, especially by the health authorities in New York.

As regards legislation, sinking all differences of opinion, I consider that we ought to accept as a basis of action, and as a valuable instalment, the recommendations of the Royal Commission. The effort to give effect to these will, at all events, enable us to do much useful work, and will give us time to realise clearly what further legislation is required. If, however, it were possible to give further aid to farmers desirous of getting rid of tuberculosis from their stock, and to make further provision by way of skilled inspection to assist them in keeping the disease at a distance, doubtless an impetus would be given to the crusade against tuberculosis. At the same time I would gladly have what the Commission recommends. It may be that progressive counties such as Lancashire will pave the way to

the general adoption of a veterinary service by initiating such a service in their own county.

As regards administration we are certainly much hampered, at present, by the want of adequate powers. But there is always a good deal to be done under existing powers, though it is not easy for one Authority to go much in advance of its neighbours without exciting a sense of injustice than which nothing can be more inimical to progress.

A final word on a different and bolder programme. Prof. Delépine advocates the sweeping policy of clearing out tuberculosis by the application of the tuberculin test generally, accompanied in the initial stage by imperial compensation for the animals destroyed. Possibly this is the better policy to pursue, as it is assuredly the more radical. For a time, at all events, I should prefer to go more gradually to work.

At the close of his paper, Dr. Niven formally moved the following resolutions:—

That this Meeting recommends the Council of the Institute to take such action as may best promote the following objects:—

(1) The introduction into Parliament at an early date of a Bill giving effect to the recommendations of the Royal Commission on Tuberculosis.

(2) The immediate acquisition by sanitary authorities of powers similar to those contained in the Glasgow Police Amendment Act, 1890, Sec. 24–27.

(3) The urgent desirability for all public institutions, hospitals, etc., especially those which are rate-aided, to obtain their milk supplies from herds guaranteed free from tuberculosis by a competent veterinary surgeon.

(4) The provision by the Minister of Agriculture (in conformity with the recommendation of the recent Royal Commission on Tuberculosis), supplying tuberculin and the services of a veterinary surgeon, free of charge, to all farmers desirous of freeing their stock from tuberculosis, on the fulfilment of the proper conditions.

[*This discussion applies to the papers by* Dr. H. Scurfield *and* Dr. J. Niven.]

Dr. F. T. Bond (Gloucester) as a Medical Officer whose work lay in a dairy district and who had had considerable personal experience in practical dairy work, more indeed than usually fell to the lot of the average medical officer, inasmuch as for ten years he had been honorary secretary of a dairy association, said that whilst he did not wish to minimise the suggestions made by Dr. Niven, he was inclined

to think that they might do a great deal more by efficient use of resources which they now possessed than by asking for fresh legislation. There were unquestionably directions in which legislative action was necessary; but, if they could use the resources they possessed more effectively, he ventured to think they would put the milk supply of the country in a more satisfactory condition than it was in at the present time. He must at the same time add that many of them somewhat under-rated the enormous improvement that had been made within the last year or so in protecting the milk supply of cows. Those who were most interested in this question of the milk supply were urban authorities and districts. They it was, who were most menaced by the dangers of an infected milk supply. They too could most effectively supply the remedy required. That remedy was pressure upon the milk suppliers. The papers that had been read showed, he thought, very clearly that the resources which they at present possessed, were adequate to protect the public not only from constitutional disease like tuberculosis, but from other diseases, especially enteric fever, of which milk was largely the possible medium. When it was suggested that large administrative powers should be placed in the hands of sanitary authorities for the supervision of cow-sheds and of dairy farms, he was afraid that many of those who made such suggestions forgot who were the administrators that were to be called upon to exercise those powers. They were very largely the persons who were primarily affected, namely, the milk-suppliers themselves, and until pressure could be brought to bear upon these authorities, upon the individuals of whom they were so largely composed, it was no use asking for fresh powers because they would be as little exercised as they frequently were at the present time. He ventured to think that what was necessary could be done within the limits of the present powers possessed by urban boards, that was to say by doing what Dr. Scurfield had suggested, and what was done in Amsterdam, and other places on the Continent, namely, to give publicity to those milk suppliers who supplied an article not only free from danger of contamination, but commercially worth what was asked for it. In England they advertised one class in the shape of the reports that the newspapers gave of convictions for adulterated milk, but not so effectively as it was done in France, where the adulterator was forced to pay for the cost of advertising his own conviction. Why should not the urban authority supply the public with the results of an examination of the milk of all purveyors and the conditions under which it was supplied? Sooner or later the milk business would proceed in the direction in which it was now moving, that was of falling into the hands of large and well-organised companies, that could afford to take the necessary precautions to protect the public.

Dr. M. K. Robinson (M.O.H., East Kent) said that at a Sanitary Congress they got able papers read, which generally led to the proposing of some resolution in favour of new legislation. He quite agreed with Dr. Bond in thinking they were apt to forget that

existing powers were not being put into operation. Every example of disease spread by milk was a lesson to the district authority where it occurred, and to those dairymen who might be members of such authority. The members of these bodies when convinced of the necessity were the first to want improvement and see their byres and cows were healthy. Publicity should be given to examples of milk which conveyed disease. He thought that through the press the public would begin to interest themselves in the question, and demand to know the kind of dairies from which they were supplied, also whether the cows were healthy. He was advising those who took milk in towns to ride out on their bicycles and look at the water supply provided for cows. They might do the same in respect to milk supply, and see how far cows were kept in a cleanly condition, and the byres also. He had himself in the course of his enquiries come across dairymen with incipient disease upon them, and at the same time engaged in milking cows. Only a fortnight ago he found fifteen people struck down with typhoid fever. It was an outbreak which from its simultaneous character and absence of other causes he knew to be due probably to milk or water. On investigation he found that the milkman himself had been suffering from typhoid diarrhœa, and that the fact had been entirely unknown to his employer. The result of representations was that the man had to retire from the office of milkman and milk-carrier until he was better. Under circumstances such as these it was very easy for typhoid to be conveyed. Better inspection of cows and dairies was required, more stringent enforcement of existing law, and greater publicity should be given to the numerous instances recorded of milk-conveyed disease.

Lieut.-General Phelps (Birmingham) thought they were much indebted to the gentlemen who had read these two papers. All would agree with them as to the extreme danger to which the public were exposed both in the matter of meat and in the matter of milk. There was one matter with regard to testing which he should like to touch upon. Dr. Scurfield said there should be a comparison with a sealed sample. He believed it was the fact that there was a great difference between the milk first drawn from the udder and the last milk drawn. That being so, he thought there was some risk of error creeping in, if the milk was taken at the beginning or at the end of the milking. Something should be done to make sure that the test was more accurate. With regard to the certificate of the veterinary surgeon there seemed to be excessive difficulty in ascertaining whether the carcase was infected by tubercle or not. Some time ago a restriction was put upon the importation of cattle from America, and he had heard it stated publicly that at Deptford, where the animals were received, the American Government was represented by a veterinary surgeon, and the English Government by another. In every case where the English veterinary surgeon pronounced the carcase to be infected by tubercle the American pronounced it to be absolutely free. So the question came in, "where doctors differ." The question of heredity was one of great difficulty. Calves readily contracted the

disease. But the incubating period took a long time before full development was reached. These things showed the extreme difficulty of the question, also that all bovine products were liable to the same risk, and possibly even lymph to be used for vaccination.

Dr. BOND cordially agreed with Lieutenant-General Phelps in asking that every precaution should be taken to ensure the safety of lymph used for vaccination.

THE CHAIRMAN: As Chairman I must exercise my right of vetoing the rider.

Mr. Councillor WHEATLEY, J.P. (Carlisle), held that they had ample legislation to deal with this matter themselves. What they wanted was that one general system of regulations should be actually enforced. Instead of advocating larger powers they should direct the influence of the meeting to the thorough enforcement of the powers that existed. They in Carlisle had practically adopted all the regulations of the Royal Commission, as far as they were suitable to their requirements, and so far they worked admirably. Among other things they had appointed a veterinary surgeon as inspector. He thought they ought to prohibit and eliminate all cow byres that were in unsuitable positions irrespective of internal air space.

Mr. BAILLIE DICK (Glasgow) pointed out that the municipal and general hospitals and infirmaries in the city of Glasgow had agreed that they would not accept milk from any dairy unless the cows therein had been submitted to the tuberculosis test and successfully proved to be free from tubercle. In this way they sought to create public opinion. They had circulated a little leaflet warning people of the dangers of the situation and to bring the public to their side. Their own veterinary surgeon visited the byres and made a periodical report. He could name two dairies in Scotland where the owners had for the last three years guaranteed and tested every animal admitted into their herds, and, if they would not pass the tuberculosis test, they were rejected. The owners were doing this on the commercial ground that they were able to guarantee the quality of milk and get a better price for it. This, he thought, was the first beginning of steps being taken by the farmers themselves to make sure that their dairies were free from infection. If they only exacted a guaranteed pure supply for their hospitals, it would go a long way towards making the thing universal.

Mr. MACINTYRE (Runcorn), as a farmer who had sent milk to Manchester for fifteen years, as supplier and distributer, pointed out that the question had not been answered as to what was done with the cows when they had been condemned. He had every reason to believe that a great many of these cows were bought up by dealers, sent into the market and sold by public auction to go back again into

the dairies and send milk into the towns. Some means ought surely be devised to stop that. The publication of the names of those who sent a good supply of milk into the towns, he thought, an excellent idea. The names of the delinquents, those who supplied bad milk, were made public, but not of those who kept good dairies. He himself furnished in some way an instance in point. He quarrelled with his milkman and the man thought to punish him by sending for the Superintendent of Police to try a sample of his milk. He had an intimation from the Superintendent to say that he had samples of milk taken from his dairy and that he could have one of them if he wished. He wrote back to say he did not intend to take advantage of the sample as he was perfectly satisfied that the milk was unadulterated. But he asked if he could, by payment, have a copy of the analysis for his own satisfaction. In return he got a polite note to say that the rules of office would not permit of that. So he could not learn how his milk stood the test. He supposed that no one else could obtain such information either. Let him refer to the cubic space of dairy cows. He belonged to the Rural District Council of Runcorn. Some time ago they had an intimation from the Local Government Board that 800 cubic feet would be necessary for every cow. Their Council was largely composed of large dairy farmers. They considered 800 feet a ridiculous space for each cow and tried to induce the Local Government Board to reduce it. They found that some Government sheddings gave only 400 feet for their cows. So they decided upon 450 feet as a fair compromise. He should like to know what was the average of the Kingdom for air space for each animal. So far as his Council were able to ascertain, they found 600 feet to be above the average.

Dr. Moore (Liverpool) replied to the assertion of Lieut.-General Phelps that there had been a difference of opinion between the English veterinary inspector at Deptford and the representative of the United States in reference to disease found in animals. He believed he was correct in saying that the difference was not in the point suggested, but as to whether or not the carcasses of various animals slaughtered exhibited traces of epidemic pleuro-pneumonia.

Dr. Symons (M.O.H., Bath) asked whether any local authority had been able to enforce the tuberculin test, if this was the only satisfactory test, most authorities would be helpless for some time. Similarly with regard to the detection of tubercle bacilli in milk, if experiments on living animals were the only satisfactory means of demonstrating the presence of these bacilli in milk, there was another great difficulty in the way of exercising proper control of the milk supply locally. He had recently inspected all the cows in Bath with a veterinary surgeon, Mr. Welch, and they had felt that without tuberculin experiments on living animals the results of their inspection were less valuable than they would have been with these accessories, although they were able to do a great deal to improve the conditions under which cows were kept. The capacity of the

cowsheds of Bath was about 600 cubic feet per cow and there was ample pasture ground.

Dr. SCURFIELD (Sunderland), in his reply on the discussion in so far as it affected his paper, said Dr. Bond thought they did not so much want new powers as to put in force the powers which they already had, but it seemed to him that they wanted new powers in order to compel the authorities to make use of the powers they now had. He was glad to hear that Dr. Bond approved of the method of advertising the results of the analyses adopted in Amsterdam, in order to keep up a competition between the suppliers, as to which of them could supply the best milk. Lieutenant General Phelps referred to the difficulty of obtaining a fair sample of milk for reference. The farmer would be allowed to state in court from which cow or cows the sample, on which the proceedings were founded, was taken. Then the inspector would attend to see the cow or cows milked from start to finish and take a sample from the milk after it had been well stirred. If the sample so taken corresponded in its analysis with the original sample, this would constitute a valid defence against proceedings for adulteration. One speaker had asked, what a farmer, who voluntarily went in for the tuberculin test, was to do with his reacting animals? He would have to let them go dry and fatten them for the butcher. The fact of a cow having been shown to react to the tuberculin test did not make it worse than it was before. If a cow had tubercle limited to the lungs, it would not make the flesh unfit for food. The recent Royal Commission had given fairly full recommendations on this point. Most of the reacting animals would go to the butcher. It might be that some of the reacting animals would go to other dairy farms, which would simply mean the addition of one more reacting animal to a stock, of which probably 40 per cent. would react if tested. Such a possibility did not interfere with the fact that it was a great gain to have a number of farmers owning herds entirely free from tuberculosis, setting the example, and preventing the spread of tuberculosis in their own herds. It was well known that the danger from the meat was infinitely less than the danger from the milk. One of the resolutions now proposed by Dr. Niven was almost identical with a resolution passed by the Congress of the Institute two years ago at Newcastle. Another of the resolutions passed two years ago was that every cow that was tested and found to react to the tuberculin test should be branded. It was certainly advisable that cattle which reacted should not be sold except to the butcher, and the only way to secure this was to have the reacting animals branded, and to impose a penalty on anyone selling such animals except for slaughter. He was glad to hear that the public institutions of Glasgow had taken up the question of getting milk from tested herds. The Fever Hospital in Sunderland was, he believed, the first institution to do this. In answer to the question about air space it was well known that the amount required by byelaws in force in different parts of the country varied very much. He believed it was 350 feet in the county of Ayr where there was a

is to prepare the rising generation for complete living, by inculcating that right knowledge which must precede a rational life, and so raise the national standard of commercial and industrial efficiency. It is this "right knowledge" which, while guiding children to a higher level of civic duty, and fitting them for the future responsibilities of parent-hood, will lay the foundations of a wholesome, intelligent public opinion.

Experience teaches, and the statistics of the last half century go far to prove, that the main causes of the varying health conditions of a population are impurities of water, foul air, dirt and poisonous dust, zymotic infection, overcrowded dwellings, imperfect drainage, and last, but not least, mismanagement of children; and that these pernicious influences can be controlled by individuals and corporate bodies, though progress is seriously impeded by the prevalent ignorance of, or indifference to, the subject of sanitary reform. It would seem, therefore, that a sound knowledge of the elements of hygiene (personal, domestic, and public) should, and would, constitute an important item in the training of our children, since again experience shows that enlightenment, *not* coercion, is the only satisfactory resource to effectually remedy the results of widespread ignorance. People cannot be forced into a new road, even though it be the right one; but, to paraphrase Horace Mann's picturesque simile—"the avenue must be hung with the starry lights of knowledge, to show the ignorant not only the direction of the course to the goal of prosperity and health, but the beauty and pleasure of the way that leads to it."

After noting that the Privy Council Committee on Education express satisfaction in their 1896–7 Report, at the increasing attention being paid to "those homely, but withal scientific lessons, which best arouse the interest of the children, because they are nearer to their personal experience of daily needs, and to the actual circumstances of their life," a reasonable expectation is raised of finding a prominent position assigned to this subject in the latest Codes, and that no exertions are spared in promoting the spread of sanitary knowledge in elementary schools. The outcome of some recent enquiries instituted with a view to testing the accuracy of this deduction is collected in the following notes, and is somewhat disappointing in its tenour.

According to the latest returns, accommodation is provided in the 19,957 elementary schools in England and Wales, for one-sixth of the population, *i.e.*, 6,220,158 children; 5,509,845 names are found on the school registers; with an average attendance of 81·5 per cent., equal to 4,489,043. In all these schools the teaching of four subjects is obligatory, viz., reading, writing, arithmetic, needlework for girls and drawing for boys.

To complete the grant-earning curriculum, choice is allowed of two out of ten optional "class" subjects (singing, recitation, drawing, English, geography, elementary science, history, needlework, and domestic economy, which includes the laws of health, and is limited to girls): and, for individual children in the upper classes of the school, selection may be made from twenty-five "specific" subjects, including algebra, mechanics, chemistry, physics, Latin, French, shorthand, book-keeping, domestic economy, cookery, laundry, and dairy work for girls, cottage gardening and manual instruction for boys, hygiene for both sexes. Each child presented for examination in "class" subjects can, if successful, earn a grant of 1/- to 2/-; for "specific" subjects the amount is variable, 1/- or 6d. for every complete 24 hours (not less than 40 or over 60). No grant is made for housewifery, though this is now recognised under the Code as a subject of instruction. As a rule it is left to the discretion of the individual teacher to settle what these "optional" subjects shall be; "a system," as one of H. M. Inspector's writes, "which will hardly stand the test of critical investigation from an educational point of view; should not," he asks, "the subjects taught be settled by a consideration of what is best for the children and by nothing else?"

To those unversed in the intricacies of the existing educational code, it may be well to explain that instruction in the laws of health need not necessarily be, and, indeed, is not confined to the subject of "hygiene," as it figures in the Codes of Elementary Day and Evening Continuation Schools, but

(*A*) "Class object" lessons on materials used for food can be and are given even in Standards I. and II.; while in Standard III. teaching on the chief materials used in clothing and washing is optional.

(*B*) Children in Standards IV.—VII. can receive elementary theoretical instruction on the nutritive value and function of food; the skin and personal cleanliness; the dwelling—its ventilation, cleansing, &c.; rules for healthy living, and so forth; these last being classified as "domestic economy" and confined to girls only.

(*C*) Under the head of "elementary science" (when both sexes are equally eligible for instruction) nine alternative courses are carried on, principally by experiment, and the exercise of the children's own powers of observation; animal physiology and chemistry being included. In the specimen course, given in the Day School Code, 1897—98, it is suggested that the teaching on (*a*) simple chemical laws should show their application to common life; on (*b*) the outlines of physiology, their bearings on health and work; while (*c*) stress is

laid on the wisdom of employing, as familiar illustrations of applied science, the dwelling, food, warming, &c.

(*D*) "Domestic science and hygiene" is a new "specific" subject introduced in the Code of 1897—98 for individual children in the upper standards. "The lessons deal with the science underlying many of the rules and operations of the household, and aim at presenting the facts connected with the subject of domestic economy upon a reasonable basis, thus training the scholars to observe critically, to think accurately, and to form correct judgments"; all which pre-supposes considerable intellectual development.

(*E*) Again, in the long list of science subjects to be found in the Evening Continuation School Code, 1897–8, excellent optional schemes of instruction covering much of the desired ground are to be found in the "Science of Common Things"; the two alternative schemes for "Hygiene"; or, under the heads of "Miscellaneous Subjects," and "Domestic Economy": consequently valuable teaching in various branches of sanitation can be given throughout our elementary schools under cover of one or other of the above-mentioned "class" or "specific" optional subjects.

It would appear from the figures available in a recently published Report of the Education Department, that the total number of departments in which scholars were examined in "class" subjects in 1896–7 was 23,080; Geography was taken in 16,646, English in 14,286, Object Lessons in 8,321, or 36 per cent., Elementary Science in 2,617, or 11·3 per cent., and Domestic Economy in 633, or rather less than $2\frac{3}{4}$ per cent., this proportion being well exemplified in the following extract from a table published in the Report alluded to above:—

County or Town.	No. of Schools.	No. of Scholars.	No. of Departments in which Scholars were examined in.				
			English.	Geography.	Elem. Science.	Object Lessons.	Domestic Economy.
Bedfordshire ...	153	30,374	98	121	12	39	6
Dorsetshire	278	35,115	116	215	7	185	5
Norfolk	497	38,356	315	334	34	224	...
London	956	738,195	1007	1129	314	433	129
Leeds	105	74,168	81	158	...	6	2
Bradford	62	39,320	10	86	5	5	...
Sheffield	84	61,266	97	134	47	93	5
Sunderland	30	26,206	47	40	...	14	1
Leicester	51	37,113	18	55	32	13	...

These figures, however, afford an example of the danger of

drawing conclusions from statistics only. It appears that under some Boards, children are not presented for examination in all the "Class" subjects taught in the Schools; either because of a disinclination on the part of the Authorities to comply with the Government Regulations, or, as may be the case in wealthy towns, the amount of grant earned being so nominal as to be of small account. Of such teaching the Education Department receives no official returns, in fact particulars could only be obtained by direct application to the Clerk of each Board; consequently there is great difficulty in gauging the proportional popularity of "Class" or "Specific" subjects, or of the number of children instructed in them respectively. The optimistic educationalist unhesitatingly asserts, therefore, that the teaching of sanitary science under one or other of its possible forms is far more widespread than would appear from published statistics. The proof of this statement may be looked for in the resultant effects on the national health during the next few years.

London is well to the front in teaching Domestic Economy, probably 23 per cent. of the girls in Standards V., VI., VII., and Ex. VII. (about 10,656) receiving definite theoretical teaching therein. In 1891 the London School Board, too, made a splendid and still unique departure in the right direction, by initiating Housewifery Centres (the number of which will shortly be increased to 7) where first-rate instruction, principally practical, is given in the general routine of a day's work in the house of a labouring man, eminently calculated to fit the girls to conduct their homes creditably in the future, the methods being sound, and the teachers equally able, highly qualified, and zealous. These classes are limited to 14, and are attended only by girls in Standards V., VI., and VII., who receive 44 half-day lessons a year; the course extending over 3 years, and including cookery, laundry, household management, and home nursing. Should the Education Department signify its approval of this scheme, there is reason to believe it would be widely developed; in so much that its originator looks forward to the advantages being extended in the near future to every girl above Standard IV. attending the London Board Schools. Upwards of 38,000 girls (about half the possible number) in Standards IV. and V. learn practical cooking each year in London, at 160 centres, where non-Board School girls are permitted to attend on payment of a fee of 4s. for 20 hours' lessons: the course comprehends 22 lessons in 2 consecutive years. About half as many pupils are to be found at the laundry centres. In the late Senior Chief Inspector's Report on the Metropolitan Division,

1897, it is gratifying to read that "there is a growing tendency on the part of the voluntary schools to take up domestic economy as a Class subject, and to render it practical by connecting it with cookery and laundry work."

As examples of systems pursued by other important Boards, it may be noted that in Leeds, domestic economy is taught theoretically in all the girls' day schools in Standards V. and VI., *i.e.* to 18·3 per cent. of the total number of girls, cookery only being taken practically. Physiology is taught to "some" of the boys. The former subject is not popular in the evening continuation schools.

In Sheffield, a peripatetic Science Demonstrator gives one lesson, fortnightly, of about fifty minutes' duration, on "Food;" or, "The Dwelling," to girls in the V. and higher Standards, *i.e.*, to 16·88 per cent. of the total number, the lesson being illustrated experimentally by specimens and apparatus carried from school to school. About 1,000 girls attending evening classes were instructed last season in the course described as "The Science of Common Things," which includes natural and artificial ventilation, and "Some Common Adulterations of Food." In Bradford, practically all scholars, *i.e.*, 27,000, are reported to receive theoretical, and about seventy per cent. of full time girls above Standard IV. experimental, instruction in elementary science and domestic economy; the sexes only diverging in Standards VI. and VII., when girls study washing experimentally, and boys work through an admirable syllabus on drainage and refuse removal.

These few particulars will indicate the varying systems in force, and the consequent difficulty of presenting any definite statement on the subject of this paper. Mrs. Pillow writes in her special report on "Domestic Economy Teaching in England, 1896–7," that "excellent work in training girls in one or more of the domestic sciences, both practically and theoretically is being done under *nearly all* the larger, and many of the smaller school boards, as well as in many voluntary schools throughout the country;" doubtless she had facts and figures at her disposal in support of this opinion, not generally accessible.

The result of a calculation, which, owing to the difficulty of obtaining detailed figures, is only approximate, shows that rather more than two per cent. of the girls in our elementary schools have the opportunity of learning theoretical domestic economy, but, when boys are included, somewhat less than one per cent. of the total scholars appear to receive any instruction, even theoretical, in a subject so important in its bearing on their future, and on the national welfare. The impression resulting from many interviews and considerable correspondence with

educational authorities is, that the subject of health attainment, under the designation of domestic economy, or otherwise, is certainly not a first favourite either in elementary or evening continuation schools; that perhaps fifty per cent. of the girls above Standard IV. receive a certain amount of theoretical instruction therein; but, speaking generally, boys learn nothing on the subject at all, although to many of them, weighty responsibilities in connection with sanitation will be entrusted in later life under the existing system of local government. Just a few may come under the influence of masters such as one who writes, that "he attaches the highest possible importance to the matter of cleanliness, ventilation, &c., and has provided by means of his object lesson scheme a course on 'Simple Hygiene' for each class; constantly keeping the great importance of the subject before his staff, and never missing an opportunity of himeslf bringing it home to the boys, so keenly does he appreciate the matter from a citizenship point of view," but in the majority of elementary boys' schools the teaching of hygienic principles is merely "dragged in by the heels" in lessons on elementary science.

Suggestive of at least lack of enthusiasm, is the fact that although the study of hygiene in relation to school management is required by the Educational Department of all students in training colleges, and domestic economy is a compulsory subject in examination for Queen's Scholarships, yet both are only "optional" subjects for 1st and 2nd year certificate examinations. There are about fifty-five training colleges in England and Wales, and the result of enquiries addressed to fifty of these show that in only fifteen are hygiene or domestic economy taken up (except as part of school management), and then are studied only by about 50·5 per cent. of the 1,400 students at these fifteen colleges, all women. Taking the total number of training students of both sexes as 4,400, but 16·6 per cent. of the whole follow up these subjects (of the 2,570 women students about 28·8 per cent.). The following extracts from letters written by the principals of several important training colleges give food for reflection in this connection:—"I am only sorry that the Education Department does not treat such an important subject with proper consideration; our students were taught and examined in hygiene when the Education Department permitted it." Again: "Hygiene is not one of the subjects selected for training colleges for men—I should much doubt if a single college is paying any attention to the subject; or "Only those students take domestic economy who, through lack of training, or other cause, are not suitable for the classes in Euclid." Again and again this same remark recurs:

"Domestic economy was taught, but has now given way to Euclid"; yet, surely, if the educational influence shortly to be exercised by these students is to fit the rising generations for "complete living," they should be zealous in the cause of health protection, and able instructors in the elementary truths of sanitation.

In order to arouse enthusiasm on the subject among teachers, it might not be amiss to follow Belgian methods. The Belgian Government, having recently decided that in addition to learning what the Education Department describes as "Les Notions de l'Hygiène," all children in elementary schools should be imbued with a salutary horror of drunkenness, its causes, and consequences, issued a ministerial circular in April last, requiring teachers to give exhaustive instruction on the subject. Finding, however, that the majority were not qualified to make these lessons sufficiently forcible and attractive, the department organised a series of conferences during July, for all teachers, conducted by experts, in order to thoroughly equip its staff for this important hygienic departure.

Among the usual reasons assigned for this apparent indifference are:

1. That owing to school life being so short, it is important to select subjects of the greatest educational and disciplinary value in developing the child's general powers; and that early specialisation is a mistake.

2. That ample opportunity is afforded for a thorough study of the subject later on, in day and evening continuation schools, technical educational schools and polytechnics; by means of County Council scholarships, residential schools of domestic economy, &c.

3. That the necessary instruction cannot be given without a properly fitted laboratory; which is only provided in a few quite new Board and some higher grade schools.

4. That to insist on the majority of the girls devoting twenty lessons in two consecutive years to cookery even, is hardly justifiable, considering the very limited period of compulsory education; and that the power practically to apply the results of any hygiene teaching worthy of the name can only be acquired by children past the usual school age; to instruct them in the subject at nine or ten years old would be sheer waste of time and money.

In reply to these objections:—(1) It appears to some, at least, outside the school world, that considered from a national standpoint, those subjects are of the highest educational value which not only enhance the comfort and happiness of family life but lead to extremely important economic results in regard to

the health, physique, and increased intelligence of the masses; (2) Sir J. Gorst has stated that of 600,000 children found in elementary schools between the ages of ten and eleven, at least 500,000 drift away from *all* educational influences before the age of fourteen, so that a satisfactory *increase* of scholars in the evening continuation schools only yielded last year a total of 358,600. The number of those who can avail themselves, too, of the advantages of training subsequent to school life is very limited, *e.g.*, there are but 450 Scholarships (tenable annually for five months) in the day continuation schools for all London, neither do such figures as are available give evidence of interest in this subject; the technical education classes on sick nursing are popular, not so those on hygiene. Again, with a total average attendance of 17,021 in the London School Board Evening Continuation Schools (1897), the average attendance of scholars at hygiene classes was only 123, or less than ¾ per cent.; (3) An extract from the last report of the Education Department fairly answers another objection: "It is impossible to warn students too often that complicated and elaborate apparatus, however perfect and ingenious, are not such impressive tests of good teaching as readiness of resource, oral or mechanical, used to drive home, or to illustrate points as they occur;" and, in reply to No. 4, Mrs. Pillow's Report may again be quoted, where she speaks of the "increased home comfort, higher morality, and improved bill of health which must result even from a more general practice of good cooking."

As to age: the truths of morality which are to guide men through life are impressed on them as children of very tender years. Can good cause be shown why the simplest elements of hygiene should not be satisfactorily taught too, at an early and impressionable age, by means of suitable object lessons? Many teachers, conscientious in all they do, lose valuable opportunities, because time, or the age of the scholars, do not permit an exhaustive or "scientific" tackling of the subject. Unquestionably such thorough instruction is eminently advantageous when feasible, but is it a counsel of perfection to require that a simple, short course of instruction in Elementary Hygiene should be made a compulsory subject, taught throughout our schools, so that none could escape its influence? The lessons should be eminently practical in character, illustrated by facts familiar to the children, and given equally to both sexes; they should deal with the general laws of health, and the influence upon it of air, food, water, &c.; the precautions that may be taken against disease, infectious and otherwise; special instruction on the rearing of infants being given to the elder girls, and on somewhat more advanced sanitation to the elder

boys. The statistics quoted prove the futility of permitting this to be either a "Class" or "Specific" subject (that is optional), certainly until the general public fully realise the intimate connection between health, wealth, and happiness, and that each individual has his duties and obligations in respect of sanitation.

Were ratepayers more alive to their own interests—educational and sanitary—it is conceivable they would demand, *en masse*, that a definite proportion of the huge sum they annually contribute for educational purposes should be used to inculcate a practical knowledge of health laws. Such teaching would promote the rearing of a race sound in brain and body, so increasing the productive capacity of the Community, and diminishing the outlay now incurred on account of preventable ill-health and premature old age. It should tend also to arouse an intelligent, public spirited interest in sanitary reform, making for a reduction of the rates yearly required to remedy the insanitary blunders of preceding generations, ensuring thus a satisfactory return on the Nation's educational investment.

It is reported that in New York "a conspicuous feature of primary instruction is the formation of habits that shall lead to cleanliness, temperance, health, strength, and grace." Surely it is well worth sustained and organized efforts to secure that in England too, not only shall such habits be formed, but the priceless knowledge of health promotion and disease prevention shall be *compulsorily* included in the *obligatory* subjects of elementary education. How can public opinion be educated in a knowledge of the conditions on which public health depends until such a course is adopted? It will indeed be satisfactory if convincing proofs be forthcoming that the statistics quoted above are unreliable and the facts inaccurate; that, in spite of the conclusions reached, a sure foundation for future sanitary progress and the development of a vigorous national life is even now being laid by means of our costly scheme of compulsory elementary education; in any case, the object of this paper will have been attained if but a modicum of increased interest be aroused in the subject, and lead to certain eminently desirable, practical results.

In conclusion, sincere thanks are due for the cordial assistance given in the prosecution of these (unfortunately far from exhaustive) enquiries by members of several School Boards and others in the educational world, without which they would have been practically impossible—at least unreliable.

Mr. E. T. Morgan (Bristol) as a representative of a School Board fully endorsed everything in Miss Ravenhill's paper. One point in particular struck him. He meant the reference to the house-wifery classes. At Bristol such a class had been established, following the example of the London Board. The children were taught things appertaining to the duties of the wife or daughter of a working man. One objection raised by some of the teachers to this house-wifery class was that it was established for a wrong standard of children, that the subjects were not taken until the children were in the higher standards. It was argued that the children who really required this sort of teaching were the lowest in the social scale. In Bristol they had a peripatetic lecturer also who gave lessons on the laws of health, illustrating the effect of bad drainage and the want of cleanliness by models and diagrams.

Dr. Marshall (Coatbridge), also a School Board Member, said he had always advocated largely the introduction of subjects of science into the school curriculum, especially those relating to hygiene. But unfortunately he had commonly to deal with an unsympathetic audience. However they had adopted a curriculum tending to produce a healthy hygienic condition in their schools. They had physical drill classes in all their departments, from the infants to the highest, and for some time they had well regulated classes in swimming. Much had been done in their neighbourhood by means of ambulance and sick-nursing classes to educate the people in the general laws of health. But much more might be done in their Scotch schools than was done, as for example, by the introduction of short interesting articles on Hygiene into the various Readers, and also by the teachers giving popular object lessons.

Mrs. E. Wakeford (Bradford) said Miss Ravenhill's experience, to some extent, coincided with her own. In the West Riding of Yorkshire they were noted as a house-keeping folk. Indeed the housewives of Yorkshire were sometimes called "scrubs." In Bradford they possessed several higher grade elementary schools, one with a most extensive laboratory. At these schools there was a large attendance of middle-class girls and children of well-to-do tradesmen. She did not begrudge them anything they got, but she did feel the lack of such teaching for the poorer children. Their elementary science lessons were supposed to cover a great deal of domestic economy teaching. But, listening to a lesson on impurities in water she noted that no mention was made of the simple precaution of running off the water from the lead pipe by the tap in the morning. They laid great stress on physical culture in Bradford as a theory, and, to some extent in practice. The girls must drill in the open. But what was the use of this if they were doing this exercise close by an unsealed water gully. She regretted to say that teachers were grant-earning articles still. Surely teachers ought to teach practical

sanitation and housewifery. Of what use is Euclid to working women compared with Domestic Science? Teach them to make a decent pudding to satisfy a working man. It was of far more real value to children that they should understand how to be healthy animals, in the first place, than that they should understand the comparative value of remote colonies. There were things more important even than vulgar and decimal fractions.

Dr. SCURFIELD (Sunderland) asked Miss Ravenhill to move a recommendation to the Council of the Institute to do all they could to get elementary hygiene included among the subjects to be compulsorily taught in elementary schools. School Boards might to some extent oppose this, as a knowledge of hygiene would lead the scholars to demand either a large increase in air space or greatly improved methods of ventilation.

Mr. W. JENKINSON ABEL (Nottingham) believed that the elementary schools in the provinces, particularly those under the larger boards, were doing a great deal more in this matter than might seem from the statements published from time to time. In order to enable Managers of Board and Voluntary Schools to do still more they needed—not additions to compulsory subjects, but more freedom of work. In order to secure the maximum of efficiency of school work, payment by result should be entirely abolished; and, in its place, a reasonable fixed grant should be paid to schools satisfying general requirements as to extent and character of curriculum and efficiency of work. He did not think they should go on asking the Education Department under existing conditions, to include this, that, and the other additional compulsory subjects. A great deal of the evil from which they were now suffering had been caused by theorists—he would not say faddists—urging their various subjects on the Department without due regard to the consequent congestion of the School Time Tables. He advocated the appointment of peripatetic experts for the practical experimental teaching of Hygiene, and other science and technical subjects; and the more careful selection by teachers of limited groups of subjects best suited to the present and prospective needs of their pupils.

Miss ALICE WADMORE (London) said that excellent work was being done in the direction advocated by Miss Ravenhill, but a great deal remained to be done. It was not Euclid that the lower classes in London wanted, but laundry work, cooking, and the simple rules of hygiene. All these things a School Board could give. There was too much cramming and so-called "education" in the schools, while the practical daily life wants of the children were too little considered. Boys most certainly ought to learn cookery and hygiene, and obviously the same applied to girls.

Mr. C. E. Rice (Headmaster of King Alfred School, London) contended that something more must be done to fit the teachers for the task of teaching hygiene. The teachers must have the attitude of simplicity and the ability to teach children to look at things with their own eyes. The fact that in some training colleges Euclid had been substituted for hygiene showed that teachers were being encouraged to look at things through the eyes of a person who lived over 2,000 years ago, instead of cultivating their own powers of observation. Hygiene should be one of the most intensely interesting subjects taught, and so it would be if it were taught in a common-sense way, beginning with the child's observations of his own surroundings. The teacher who began the science of hygiene in his own school room was on the right track. At present it was taught from books rather than on the basis of personal observation. The practical point of view was the point of view that interested the child. But nothing could be done to make hygiene interesting or valuable as long as the training schools turned out teachers who were bookish rather than practical.

Dr. Carswell (Glasgow) remarked that they used to be brought up in Scotland with the old motto of "Early to bed," and taught that the one thing needed to render them good men was to take their porridge in the morning, and learn the small catechism. So they had got into the way of thinking that everything beyond that was somewhat of a pretence. But probably their grandmothers boiled potatoes, baked them wholesome Scotch bread and broth better than the modern girl, with her Board School education, could do. He was quite sure that the modern young working man's wife had got into the habit of going to the grocer's shop and buying harder bread—she had forgotten to buy meal—sausages, and the like, and she cooked the sausages, and gave her husband cooked or fried sausage and tannin—not tea. They had had twenty-five years or so of School Boards, and had neglected domestic economy. He had heard Sir Joseph Fleming refer to the danger that threatened the welfare of the race through cramming in schools. His own special work was mental disease; but he was not one of those who believed that the cramming in their school children directly resulted in the production of insanity. Facts did not prove it. But what he did believe was that a great amount of superficial education—so called education—produced a condition of mind that went to contribute to the restlessness of mind that was characteristic of the present age. Children left school with a knowledge, here and there, of different things which simply weighted their bodies, and lead them to read rubbishy books. If they could get more hygiene and better diet in their schools, it must be at the sacrifice of some other things which were now taught there.

Mrs. Southall (Birmingham) pleaded for the teaching of hygiene in higher grade schools. It was done in some of the Birmingham girls' schools with great advantage.

[illegible] thought that if cooking were taught for a [illegible] instead of for a short course only, a great deal more [illegible] by the scholars. From the point of view of [illegible] the question of the teaching of hygiene [illegible] of the utmost consequence to the growing generation that the teaching of cooking—not theoretical, for a short course, but practical—should be carried on thoroughly and efficiently.

[illegible] in her reply re-insisted on the necessity [illegible] hygiene an obligatory subject. Part of the [illegible] resulted from the unpractical nature of the [illegible] classes were crowded; hygiene classes were [illegible] of attendance. Training Colleges [illegible] in the subject, and more [illegible] that Euclid had a much better [illegible] on the mind than hygiene or cookery. She [illegible] was not adequately taught. In Belgium the [illegible] of each child was looked after, and consequently [illegible] on the importance of personal cleanliness given [illegible] on the teaching of sanitation to [illegible] of object or elementary science lessons, such as [illegible] in the schools on various other subjects. In [illegible] only one or two Board schools for [illegible] of hygiene were taught at all. Yet, at the [illegible] was the working man who set the tone of the [illegible] appreciation of the ideas of [illegible] when married, she generally had to adopt [illegible] Therefore it was of the utmost importance [illegible] hygiene. It was a matter of great regret to her to [illegible] members of the London School Board wished [illegible] Economy from the curriculum of the schools. [illegible] of these subjects, it was certain that too much [illegible] work, and too little on practical observation. [illegible] the youthfulness of the teachers. A great [illegible] practical teaching of hygiene depending on [illegible] and power of application to individual circumstances. [illegible] that a diminution of rates would follow the [illegible] teaching of this subject through the diminished [illegible] increased working powers of the population. [illegible] compulsory, it need not, and should [illegible] or add to the existing expense. [illegible]—"That this Meeting begs to recommend to the [illegible] Institute the advisability of memorialising [illegible] with a view to including the teaching of [illegible] among the obligatory subjects of elementary [illegible]."

[illegible] seconded the motion. Hygiene in his opinion [illegible] subject—the cultivation of a sound body and [illegible]—that other subjects might very well be supplemented

it. By any teacher of intelligence, hygiene might be made one of the most interesting of subjects; but the teaching must be experimental and practical.

The resolution on being put was carried unanimously.

"*Hygiene of School Life in Practice*," *by* MRS. I. WHITE WALLIS.

(MEMBER.)

HYGIENE of School Life in Practice is a subject that has hitherto been much neglected. School hygiene has been before the public as a theory for some years now and one result is that architects and engineers, who are practical people, construct almost perfect school buildings from a sanitary point of view, and these have helped materially towards the hygiene of schools.

A second result is, that to encourage hygiene in schools the Science and Art Department of South Kensington grant Hygiene Certificates to teachers on a written examination. This examination not being practical, nor based on any experience of life whatever, can be taken by any teacher of average book learning who gives fifteen hours to the subject. Consequently these examinations have had scarcely any effect in promoting hygiene in school life.

Some of these certificated teachers have frankly stated that they have taken their certificate merely to get a higher salary. They have also as frankly admitted that they know nothing about the construction of the school building and are not expected to, because a caretaker (who has not taken the certificate) is kept to warm and ventilate the rooms. As shewing her inefficiency on this point one infant schoolmistress in the North-West district of London called the caretaker into the schoolroom to open the valve of a hot-air stove about which I had made some enquiries. The man was sorry he could not help because as he said he ventilated that particular room from outside by pulling an iron rod that hung down the wall, and he did not know what happened inside to the stove, so he thought he had better not touch it.

In another school in the same neighbourhood I noticed four girls, terribly short-sighted, working without glasses; and another almost blind standing within a yard of the blackboard, with bleared and streaming eyes peering at the chalked figures

of a long division sum, which she was endeavouring to copy on to her slate. The mistress explained that the four girls had quite ordinary sight when they came up to her from the Fourth Standard two years before, and that she had done her best for all five by bringing them nearer and nearer to the blackboard every term. The class room was a large one divided by a low wooden partition, and occupied by girls of the Fifth and Sixth Standard. The children sat upon a tiered platform with their backs to the large windows. The workers could have been amply lighted had the desks been arranged so that the light could have fallen upon them from the left, but as it was, needle work, writing, and reading of small print, had all been done in the shade for over two years, except when the girls twisted their spines and slanted their eyes to catch a glimpse of direct light over their shoulders.

Mrs. C. Holland has drawn attention to the way in which Colic is rendered compulsory in Board Schools. It is a matter of still sadder conviction to those who are studying the subject, how, in spite of enactments concerning cubic space and proper lighting, physical defects and pulmonary diseases are being developed by almost all school life, and this not from want of wise legislation upon the subject, but from lack of any intelligent understanding of the meaning of the laws enacted.

Granting that advance has been made in school buildings in construction, sanitation and even furnishing during the last twenty-five years, we are still confronted with the fact that hygiene in school *life* has hardly advanced one step either mentally or physically.

As an instance in physical matters—sufficient cubic space is provided for a certain number of children in a class room; the construction is such that the room may be kept well ventilated without draught, yet from ignorance of the most elementary laws of health, the children are often all huddled together at one end of the room, breathing on to one another's bodies, while the rest of the alloted space is taken up by the teacher, the desk, and the blackboard. If to this bad arrangement of children is added closed windows and misused ventilators, what can be the result but vitiated atmosphere producing anæmic conditions? Advance has certainly been made in school furniture; well-constructed forms and desks are often to be found in class rooms; but it is still rare to find children occupying seats that fit them; much attention is paid to suitably furnishing the rooms, but little to the suitable accommodation of the children inhabiting them. The result is, postures which are mischievous to health, contracted chests, twisted positions of the spine and eyes for many hours of the day, during many years of a child's

life. Thus defects of eyesight and of lung capacity are forced upon the children during the period of their school education, preparing them to be physically incapable adults.

In intellectual matters however the question is still more serious. Dr. Sturges has shown that cases of St. Vitus Dance which reach the hospital for sick children are chiefly due to "preparing for examinations," "being worried over lessons," and "arithmetic too difficult." St. Vitus Dance is a marked physical indication of an unstrung nervous system—a danger-flag in fact which calls attention to an unseen evil and often procures for it the proper remedy. What we have to fear more is the nerve-exhaustion which creeps subtly and slowly over children whose intellects are being steadily overtaxed.

There is no need to join in the cry of over-pressure in schools. Too much may perhaps be *taught*, but it is too little, not too much, that is being *learned* in school, considering the large portion of a child's life that is swallowed up within the class room walls. It is not the quantity of instruction but the manner in which it is given that constitutes the evil from a hygienic point of view.

What is the value of the finest intellectual instruction if the child's brains are not capable of digesting the mental food provided? What the advantage of airy rooms, if the lung capacity is not large enough to benefit by them? and what the use of well constructed forms and desks if there is no one responsible for their proper use by the boys and girls who are meant to occupy them?

Theories of reform in school hygiene are matters of common knowledge to most present. What will, I think, prove of interest is a short account of the first organised attempt to put the theories as a whole into practise. For this purpose, a Society called the King Alfred School Society was founded in September of 1897 and incorporated in June of this year. By its Articles of Association the Society pledges itself to educate in accordance with the accepted laws of health under proper medical advice.

The Society opened its first school in Hampstead at Easter as a public day school for boys and girls to afford evidence of the well ascertained truth that children treated hygienically during the period of school education will attain to competent physical and mental adult life, and as men and women will retain suppleness of muscle, quickness of nerve, elasticity of mind and spirit.

The Hampstead school is governed by the Council of the School Society, to whom the Headmaster is responsible for the hygienic school life of all forms, and of the individual children

composing them. This he endeavours to secure by means of a well selected staff of teachers, who take counsel and co-operate with him and who are all working towards a common end. The consultations between teachers and parents, recommended by Dr. Sturges for the prevention of insidious nerve diseases, are secured by holding frequent informal meetings between the representatives of school and home, and by making provision for parents who are members of the Society, as well as for members of the teaching profession, to form part of the governing body of the school.

It is impossible in practise to separate the physical and mental growth of the child, for all growth is going on simultaneously. This truth is recognised by the school and acted upon in playground, workshop, laboratory, and class room. For example, both physical and mental exercise are held to be taken by boys and girls when sawing or planing, or in the general use of tools. Expansion of chest, strength of muscle, quickness in response of hand to eye, alertness of correspondence between sensory stimulus and motor response, are all being cultivated together. At the same time under the skilful guidance of the trained teacher, the child is being led to use judgment and discrimination on the materials and tools he employs. In the workshop the child is brought into contact with the realities of weight, size, hardness, and friction, and the carpentry shop is turned to account to lay the foundation of real knowledge of physics, mathematics, and geometry. In such instruction there is no over-pressure possible. The child of large capacity learns much, and the child of smaller intelligence may learn less, but the information reaches their minds by means of many senses acting together, and becomes actual knowledge, and is gained without strain.

All studies are carried on on the same principle, that is, all new matter is based upon previous knowledge already digested by the child and actually forming part of the substance of his mental life.

Language, literature, history, and geography are carefully co-ordinated as matters of study. They are taken orally to begin with and are learned by the children as far as it is possible by the employment of their own activities. Books are scarcely used by the children during the early years except to verify facts already acquired by themselves; later, while the senses are being trained to observe the surrounding objects of life, and the child's own thoughts are being brought to bear upon his observations, the printed book is beginning to be desired by the child as a friendly help to gaining information and the seeds of new ideas; and at last when by knowledge of the life about

him the child is able to value books at their true worth he has both eyesight and appetite left with which to enjoy them.

The physiological truth is understood and acted upon, that the human body is only provided with a certain increasing amount of nervous energy, and that if this stock is exhausted by what is generally called physical exercise the child has no more at hand to draw upon for mental work. Therefore in the King Alfred Schools physical strain is not considered an antidote to mental strain. Though the value to health and to character of organised games and variety of work is not under-rated, yet the whole of the out of door exercise is not taken in this way. An adequate amount of time is allowed each day for the free play of lungs and limbs; and alternating with the afternoon games, organised expeditions are taken with the staff in garden, field, or surrounding neighbourhood. During these expeditions habits of observation, of enquiry and of putting questions to nature in the form of experiment are cultivated, and thus an elementary knowlege of chemistry and botany is acquired together with the outlines of physical geography. It is found that a far larger amount of class-room work can be based upon such foundations without mental strain than is at all possible on the old plan of mere book work.

"Much grows in winter nights" says an old Swedish proverb. Mental digestion and assimilation go on then, and what has been learned handed over to the involuntary powers becomes a part of the mind. For this reason the King Alfred School allows no home lessons for young children and stripling youths. Voluntary evening occupations are provided for those whose parents are not able to regulate their children's leisure, but care is taken that no such occupation shall oppress the mind, which requires daily, long periods of tranquility and leisure in order to maintain its elasticity and freshness. A race immured to evening lessons is a bad omen for the vigour and genius of the country.

To illustrate the difficulty of awakening intelligent ideas on these matters one instance may be cited. In Hampstead during the last six months the School Society has been widely advocating the need of hygienic reform in schools, and among other things the desirability of No Home Lessons. This idea was taken up by one of the schools, and used for advertisement purposes in these words: "Next term Form 11_2, and 1_2 will have no work to take home, and therefore no books to carry to and fro." The dwarfing effects of over-burdened bodies may become apparent, but how difficult it is to make the public understand that overloading the brain is not a condition of developing but of belittling the mind.

Competitive and scholarship examinations are not worked for in the schools. All mental energy expended is directed towards the acquirement of knowledge and the accomplishment of good work. The saving of worry and anxiety to both teachers and scholars thus effected shows itself in the vigour and joyousness with which each new difficulty is undertaken and mastered. Progress is made under these healthy conditions which proves almost incredible to those only acquainted with the use of the old methods of goads and rewards in the paths of school learning.

Experience in private teaching has again and again proved the excellence of education under such hygienic conditions, by the ease with which boys and girls, and young men and women, have been prepared to pass into public schools or colleges, or into the Universities.

Recognising the fact that congregating children in school buildings is a source of danger to public health, the Society requires that all parents shall at once be apprised of any case of infection that enters the school. This gives the home an opportunity of guarding against any possibility of spreading the disease, by preventing those who have been exposed to infection from inadvertently mixing with others in private gatherings or in public buildings or conveyances.

In conclusion allow me to say—if the Sanitary Institute would press the need of hygienic reform in the school life of the English people, in the manner that it has done in almost every other department of civil and domestic life; and if it would take up the subject in the same spirit in which it undertook the reformation of the office of sanitary inspectors, there is little doubt that before the century closes the seeds of a more rational education, conducing to the healthy development of body, mind, and character of the children, might be sown throughout the kingdom.

Such an education would bear almost immediate result in a well-conditioned, reasonable-minded, adult population, capable of carrying out the laws of wise hygienic legislation, and of profiting by the advantages of a life of civilisation.

Lieut.-Gen. Phelps (Birmingham) described the paper as one of the most important read before the Congress. Ventilation was greatly mismanaged, particularly in towns. The room in which they were gathered was a case in point. In schools, ventilation, as a rule, was entirely neglected. He knew of a case in which there was a room about sixty feet long, with class rooms of smaller size leading out of

it. The ventilation was from one room into the other, so that the foul air of the first went into the second, of the second into the third, and, because they could not have the window opened, that was what the children had to breathe. Small-pox broke out and the cases were restricted to the children who used that foul air receptacle, the third room. There could not have been a more perfect proof of the fact that small-pox was due to insanitation. The proof of that was to be found by looking round at the present time. There was absolutely no small-pox in England now.

Dr. J. F. J. SYKES (St. Pancras) expressed regret that points foreign to the subject of debate should be introduced into the discussion. Turning to Mrs. Wallis's paper he remarked that the story of the stove brought home the fact that in nearly all their Board Schools the architect had devised a magnificent fabric with wonderful appliances, and left them to caretakers, and teachers, and children who did not know how to use them. They must educate the educators. The proper method of teaching hygiene was by object lessons with what already existed in the schools. It only wanted the *nous* of the teacher to grasp the practical application of a scientific fact, and then elaborate upon it in a manner as to bring it home to the diminutive intelligence of a small child. Medical officers of health had to enquire into the origin of infectious disease in a form that brought them in close relationship with schools. What was needed was that the medical officer of health should have not only major diseases but minor ones also notified to him. But at the present moment the medical officer had no right to enter a school building unless he had received an actual complaint giving him such reasonable cause to enter, as would enable him to obtain a magistrate's order if one were needed. At that moment his authority was fighting a large pioneer girls' school, because the lady inspector could not enter the premises. They had now a case in the High Court to define what their powers were in the entering of schools. The power of sanitary authorities in regard to schools ought surely to be equally as great as it was in regard to workshops. The exercise of such power would not only give the authority the control of infectious diseases, but also the prevention of overcrowding, and the supervision of sanitary arrangements. It would also enable the medical officer with more authority to give the teachers and children information as to the proper means of using the school. Even the medical officer of a large school board could not look after the whole of the schools under his charge. The only satisfactory way was to put power into the hands of the Sanitary Authorities.

Mrs. WAKEFORD (Bradford) asked whether it was reasonable to give any man or woman the care of three, four, or five hundred children for so many hours a week, without seeing that there was some guarantee that these children's physical welfare should be looked after with ordinary intelligence.

Dr. Sykes proposed: "That the Council of The Sanitary Institute be recommended to represent in the proper quarter the necessity for sanitary authorities having the same powers in the case of schools as in the case of workshops."

Mr. T. Vincent Jackson (Wolverhampton) seconded the motion, and it was carried unanimously.

Dr. Alfred Hill (the President of the Section) said that in pursuance of the suggestion contained in his address, that some resolution should be passed with a view of moving the Government to enquire into the action of food preservatives, and so set at rest any doubts upon the question, establishing either their innocence or their harmfulness, he had had the following drawn up for submission to the meeting:—"That Section I. of the Congress recommends the Council of The Sanitary Institute to present a memorial to the proper authority, calling attention to the recommendations of the Food Products Commission, and urges the investigation by recognized scientific authorities into the effects of preservatives upon health be forthwith set on foot, and that a court of reference be established." This, he said, brought the matter to a focus. They might go on for years meeting at these congresses and discussing abstract questions, but what they wanted was action, and prompt action, and the resolution he proposed would be something towards it. He had no doubt the Council would accept their suggestion, and would submit the resolution to the proper quarter.

Mr. Vincent Jackson seconded the resolution, remarking that it would form a pretty coping stone to the very admirable and valuable address which the chairman gave them.

The resolution was agreed to.

"*The Decline in the Birth-rate*," *by* Dawson Williams, M.D., F.R.C.P.

(Fellow.)

In a recent volume, to which he gave a somewhat sensational title—*A quoi tient la supériorité des Anglo-Saxons*—M. Ed. Demolins discussed in a very suggestive way the point of view of the average Englishman and Lowland Scot towards the family, and the influence of his domestic habits on the welfare of himself and his children, and on the extension of British influence throughout the world.

Shortly put, M. Demolins' explanation of the superiority of

the Anglo-Saxon is his want of thrift. He has never accepted the fallacy embodied in the musty proverb that a penny saved is a penny gained. On the contrary, he looks upon a penny gained as a penny to be spent. He lays it out in better food, better housing and clothing, in fact, in procuring that comfort which is of the essence of home. The home then becomes to him an ideal worth working for. Most Anglo-Saxons of the agricultural and artisan class make inadequate provision for old age, which is the defect of the quality. The Frenchman's great ideal in life is to save money for his old age; for this end, during the active years of life, he lives in a hovel, starves himself and his wife, and limits his family. The Anglo-Saxon is as the servant in the parable who received five talents and "went and traded with the same and made them other five talents" and was commended; whereas the Frenchman is as the servant who was afraid and went and hid the talent in the earth, and was rebuked as "wicked and slothful."

The writings of some English philanthropists and social reformers of various kinds who have enlarged upon the evils of over-population, though they may have failed of their full effect, have yet impressed deeply upon the public mind the idea that the population of Great Britain is increasing by leaps and bounds; and that special methods are requisite for dealing with the difficulties thus created for present and future generations. The fact that the population question in France took a form which was the converse of that which it was supposed to present in this country, gave occasion for essays on the blessings of free trade, or on the immorality of the French. It was therefore rather surprising to many in this country to find that the census of 1891 showed that there had been a very notable diminution in the rate of increase in the population of England and Wales. The discovery, however, seems to have produced little effect on popular opinion, in spite of the fact that the manner of its revelation was not wanting in a certain dramatic suddenness.

It is well-known that for many statistical purposes, and in particular for the calculation of the annual birth-rate and death-rate, it is the custom to estimate the population in each year which intervenes between the decennial taking of the census. The estimation is based upon the observed rate of increase deduced from the result of previous censuses. When the census was taken in 1891 it was discovered that we had been making an over-estimation of our population in England and Wales; and that whereas the estimate expected an increase since 1881 of, in round numbers, three million and three-quarters, the actual increase as ascertained by enumeration, was only just over three millions.

The growth of a population is determined by two factors—(1) the balance between births and deaths; and (2) the balance between immigration and emigration. The decline in our rate of growth has been due to a disturbance of both these balances.

The births were 290,000 below expectation.

Emigration was 412,000 above expectation.

The death-rate was lower; so that, in fact, the natural increase on balance of births and deaths ought to have been larger. Some legitimate doubt may be felt as to whether the increase of emigration has been as remarkable as the census figures would appear to indicate. If they are to be trusted, the number was 600,000 in the ten years ending 1891, as compared with 164,307 in the ten years ending 1881. It must be remembered, however, that every person who left the United Kingdom for places outside Europe was counted as an emigrant, and that with improved steamboat facilities and increased rapidity of travel the same individuals must in not a few instances have been counted several or many times. Especially must this have been the case in the Atlantic steamboat liners. It is probable, therefore, that emigration as a factor in checking the increase of the population was less effective than would appear from the statistics. If this be so, the relative importance of the diminished birth-rate has even greater significance.

The age distribution of the population of England and Wales, as enumerated in 1891, showed an alteration, as compared with the previous returns, which was exceptionally large and peculiarly significant. This noteworthy feature was the great decline in the proportion borne by the children under ten years of age to the total population. The decline is attributed by the Registrar-General to the extremely low birth-rate of the ten years 1881–90. During these years the birth-rate averaged annually only 32·5 per 1,000 living, whereas the averages in the two preceding decennia had been respectively 35·2 and 35·4. Since 1890 there has been a still further decline in the birth-rate. In 1894 it was only 29·6, in 1895 there was a slight recovery to 30·4, but this was not maintained in 1896, when the rate was 29·7.

Year.	Birth-rate.	Death-rate.	Year.	Birth-rate.	Death-rate.
1891	31·4	20·2	1894	29·6	16·6
1892	30·5	19·0	1895	30·4	18·7
1893	30·8	19·2	1896	29·7	17·1

If the total population be divided by sexes into those under

25 years, and those over 25 years, we find that in the first age period—under 25 years—there are more males than females, while in the second period—over 25 years—there are more females than males.

The excess of males under 25 is due to the larger number of male births.

The excess of females over 25 is due in part

(1) to the effects of emigration, and in part

(2) to the longer duration of female life which leads to an accumulation of females at the later ages.

Now it may be here remarked incidentally that a female at what the Registrar General politely calls "a later age" is of little use so far as increase of population is concerned, especially if she be unmarried.

Since the preparation of this paper was commenced Dr. May (late M.O.H. Aston Manor) has published an interesting paper* on the birth-rate. In it he gives a chart of the annual marriage and birth-rates for England and Wales for the last thirty years, which shows a general parallelism. It should be added that the illegitimate birth-rate shows a slight decline. Dr. May compares the marriage-rates and birth-rates for the 20 years, 1856-75 and 1876-95 respectively. In the first period the average marriage rate was 16·8 per mille, in the second 15·1 per mille, a fall of 10 per cent.; the average birth-rate was in the first period 35·1 per mille, and the rate is now 29·7, a falling off of 15 per cent. He argues that the decline of 10 per cent. in the marriage rate for 20 years will account for a like decline in the birth-rate. This leaves a decline of 5 per cent. in the birth-rate to be otherwise accounted for. Upon this point he remarks :—"One has not far to seek to find other and unnatural causes at work to account for this difference. There is the example of our French neighbours, among whom the average annual birth-rate for the ten years 1887-1896 was 22·6, being 0·7 higher than their average annual death-rate for the same period. There has been the teaching known as the 'Fruits of Philosophy,' in practical operation for many years, and plenty of object lessons in the newspapers as to the frequent practice of abortion in single and married life. The registered deaths from premature birth have risen steadily from 14 per 1,000 in 1882 to 19 in 1896, and the deaths from abortion and miscarriage from 6 to 14 per million of the population in the last ten years."

How far the causes indicated in this paragraph are sufficient

* "Public Health," September, 1898.

To account for the decline it is not easy to say, but there would certainly appear to be a progressive decrease in the fecundity of married English and Welshwomen.

In 18[illegible] [illegible]000 wives of reproductive age produced 292 infants.
In 18[illegible] - - - - - - 286 "
In 18[illegible] - - - - - - 264 "

This apparent decline in fecundity may be due in part to the fact that the average age at which women marry is now somewhat later than formerly, since this would probably tend to reduce the proportion of newly-married women under forty-five, and fecundity is greater, speaking generally, in the earlier years of marriage than later on.

Year	Average Age of Women at Marriage	Year	Average Age of Women at Marriage
[illegible]	25·[illegible]	18[illegible]	26·08
[illegible]	25·[illegible]	18[illegible]	26·19
[illegible]	25·[illegible]	1893	26·23
[illegible]	25·[illegible]	18[illegible]	26·15
[illegible]	25·[illegible]	18[illegible]	26·16
[illegible]	26·13	18[illegible]	26·21

It is a rather curious fact that the proportion of bachelors in a given number of males decreases steadily, not only during [illegible] also. The Registrar-[illegible] of the report, "that [illegible] to longevity than [illegible] marriage appears to be [illegible]

[illegible] that [illegible] the urban and the rural [illegible] in the ratio expected, but [illegible] less in the latter than in the former. The increase in the urban population was sixteen per cent., the [illegible] rural population, including in rural districts all [illegible] less than [illegible] inhabitants, was only $3\frac{1}{4}$ per cent. [illegible] counties in which agriculture is the main industry, [illegible] has actually declined. This was the case [illegible] the Welsh counties, and the border counties of Hereford [illegible] (2) in Lincolnshire and the East and North Ridings of Yorkshire; and (3) in Cornwall, Wiltshire and [illegible]

If the ages of the populations of town dwellers and country dwellers be compared, it is found that there is in towns as compared with the country an excess of persons between fifteen and forty-five years of age, that is to say of persons during th[illegible]

reproductive period. At all other ages there is a deficiency in town with one significant exception, namely, that the proportion of young children under five is not deficient. It is almost exactly the same in town and country.

If the number of town dwellers, excluding children, above and below forty-five years of age, be compared with the number of country dwellers, the disproportion is seen to be very considerable.

In a million persons dwelling in towns 177,616 are over 45. In a million persons dwelling in the country 221,317 are over 45.

	Urban.	Rural.
0—15	347,272	359,664
15—45	474,112	419,019
45—	177,616	221,317

In view of the disproportionate number of town dwellers at the reproductive period the number of children under five might have been expected to be higher in towns. As a matter of fact more infants are born in towns than in the country in proportion to the population, but the infant mortality in towns is so much higher than in the country that the town excess of births fails to maintain an excess in proportion to the total population.

The baneful influences of towns on child life is brought out clearly by the age distribution during the next ten years of life. As has been said, there is in towns, in spite of the large number of infants born, no larger number of children living, under five years of age, than in the country. There are fewer children between five and ten years of age and fewer also between ten and fifteen. The figures are per million:

In towns, children, 5 to 15 224,748
In the country, children, 5 to 15 237,143

In other words where you have in a given country population 100 children between 5 and 15 in the same population in a large town you have only 95.

The great improvements brought about by public health legislation, using that term in its widest sense, have affected persons in adolescence and in early maturity. After 35 the improvement is less down to 60 or 65, and the death rate of infants (under 1 year) does not show any improvement, but rather the contrary. The average infant mortality per 1,000 registered births was 141·8 in the ten years 1881-90; it was

150·2 in the six succeeding years 1891-96. It was higher in the year 1895 than in any year since 1870.

Infant mortality (under one year) per 1,000 *registered births, and death-rate all ages per* 1,000 *living.*

Year.	Infant Mortality per 1000 Registered Births.	Death-rate all Ages per 1000 living.	Year.	Infant Mortality per 1000 Registered Births.	Death-rate all ages per 1000 living.
1881	130	18·9	1889	144	17·9
1882	141	19·6	1890	151	19·0
1883	137	19·0	1891	149	20·2
1884	147	19·0	1892	148	19·0
1885	138	19·0	1893	159	19·2
1886	149	19·0	1894	137	16·6
1887	145	19·0	1895	161	18·7
1888	136	17·8	1896	147	17·1

The decrease in the birth-rate would appear to be progressive, and whatever opinion may be thought most plausible as to its cause, ought to arouse greater interest in the very high mortality of infancy and childhood. Of deaths in infancy some are inevitable, being due directly or indirectly to congenital feebleness; but others, and these form by far the larger portion, are preventable.* In early childhood a still larger part of the high mortality is preventable. Its causes are notorious. Diseases of the gastro-intestinal tract, classed mainly under the vague and all embracing term, diarrhœa, are responsible for a very large share. They might be greatly lessened by a purer milk supply, and still further reduced if other well-understood precautions were taken. In the same way it is certainly within our power very greatly to diminish the prevalence of tuberculosis, which directly and indirectly is responsible for a very large mortality, and for much impaired health in childhood. Lastly we have to look forward, probably to a more distant future when it may be possible if not to stamp out measles and whooping cough, at least to prevent the huge mortality which these diseases now produce in infancy and childhood. When these problems have been seriously attacked, and for a successful assault the co-operation of the public is necessary, the declining birth-rate may, perhaps, be regarded with more complacency than is now justifiable.

* Such as Infanticide or overlaying.

CONGRESS AT BIRMINGHAM.

SECTION II.

ENGINEERING AND ARCHITECTURE.

PAPERS AND DISCUSSIONS.

"*The Construction and Ventilation of House Drains*," *by*
Prof. A. BOSTOCK HILL, M.D., D.P.H.Camb.

(FELLOW.)

IT might at first sight be thought that a subject like this in the present stage of sanitary science had been definitely settled, but as a matter of fact we find that on some points authorities still hold divergent views. The questions of amount of fall, materials of pipes, &c., no doubt are agreed upon; but certain other points give rise to controversy on different forms of procedure in different districts. I have not the least intention to occupy your time by reiterating those parts of the subject upon which all are agreed, but I desire for a few moments to call attention to certain points, especially in connection with what are known as compound drains, more particularly as this subject has had of late a local interest. This question of the relation of house-drains to so-called compound drains and sewers has been forced on public attention by certain well-known decisions of the High Court; decisions given mainly to settle the point—what is a drain and what is a sewer? The subject is of importance because sewers by section 13 of the Public Health Act are vested in the local authority, while drains of course are the property of the private individual.

In the past, at all events in the Midlands, it has been customary for the small contributory drains from a row of houses to join a larger one which connects with the public sewer. Most of the difficulties have arisen in cases of this kind. As regards the construction of these drains the size and methods of disconnection and ventilation are the chief points to be considered. As to size of drains, the smallest which will convey the necessary quantity of liquid is certainly best for reasons of cleanliness. From a single house a 4 in. pipe is

[illegible], yet I have been very surprised to find that in case of [illegible] cottages a 6 in. pipe has been insisted upon by some surveyors, and so far as I can understand the only reason urged for this is the less likelihood of the pipe becoming blocked. But even if this be true, which I take leave to doubt, there are many counterbalancing disadvantages. From small houses the waste water comes down chiefly in gushes, the pipe itself if it be as much as six inches is never nearly filled, but the sides get [illegible] and they are in a very short time dirty, and have on their surfaces matter in a state of putrefaction. Again it is impossible to flush a pipe so large as six inches coming from a single small house, so that although such a pipe may not become so frequently stopped up, still, it is in a condition in which sanitary science has conclusively proved a house drain should not be.

It is, however, on the questions of disconnection and ventilation that the greatest differences occur. The bye-laws in many towns state that every drain shall be cut off by an intercepting trap from the sewer. The judges have decided that a so-called compound drain on private property is a sewer, therefore, as sanitary authorities, we must insist on the presence of an intercepting trap between each of the contributory drains, and the common drain which has become a sewer.

Let us suppose for the sake of argument that legally a compound drain, though on private ground, is a sewer. As the bye-laws were formulated some years previous to the legal decision, we may take it as at least doubtful whether the compound drain was intended by the sanitary advisers of those who framed the bye-laws to be so considered; and we may also consider whether though legally a sewer, it is desirable from a sanitary point of view to treat it as such, as regards our methods of disconnection and ventilation. Let us consider this for a few moments. The object of a drain is to remove, as quickly as possible, from the neighbourhood of the dwelling, foul water which has passed into it. The law here steps in, and those who choose to consider it binding insist that at each junction of a sub-drain with the compound drain (legally a sewer), there shall be a disconnecting trap between the house drain and the compound drain, so that in a row of six houses we shall have [illegible] intercepting traps between the various sub-drains and the compound drain. Each of these traps holds a considerable quantity of liquid and solid matter, and as a trap is an obstruction to the regular flow of the liquid passing through the drain each of these siphons becomes for the time being a small depositing tank where solids in suspension precipitate themselves. The compound drain is treated in one of two ways

either it is made to discharge into the street sewer without an intercepting trap at all, and connected with a ventilating shaft running up to the roof of one or more houses, or else an intercepting trap is put just where it enters the road, an air inlet as in the case of the other traps being provided, and a ventilating shaft being taken from it at or near its highest point. In the latter case we ventilate only that part of the sewer which is on private property. In the former case we utilize private property for the ventilation to some extent at least of the public sewer.

Under this system, which I regret to say is becoming common in many instances in the Midlands in new property, the following must of necessity occur. Each of the siphons on the branch-drain holds foul water; in the case of the house having a water-closet, which is the rule at the present time, the trap holds fæcal matter as well. The inlet which is on the drain just on the house side of the interception trap, and when no water is coming down may act as such, becomes an outlet every time a flush of water is sent down, and the fouled air, which the length of house drain contained, coupled with the gas which has been given off by the fouled matters in the trap, is discharged into the air in close proximity (in some instances not more than 6 or 7 feet) to the back-doors of the houses.

My experience then is that from these so-called inlets, acting frequently as outlets, constant smells from foul gases arise; and I have had ample evidence that the tenants complain loudly of the existing state of things. A diagram was shown which gave an actual occurrence observed by a sanitary official in Birmingham, where the so-called inlet was being used as an outlet, while the flushing of the closet was performing the function of a bellows, and thus enabling the children of the cottages to amuse themselves by utilizing the soiled air from the house-drain for the purpose of blowing up their miniature bonfire.

In a close and crowded neighbourhood such a condition of things is undoubtedly bad, even if there be no specifically contaminated matter in the drains; but in the case, say, of typhoid fever existing in property drained in this way, it seems to me that even if disinfection of stools had been carried out in the best known possible way, there would be considerable risk of further dissemination of the disease. It is certainly undesirable to store the sewage even for a short time near premises; and I am strongly of opinion that the method which I have described, while no doubt complying with the letter of the law, induces a state of things, from the sanitary point of view, very much worse than the system which it has superseded. I have known instances where, to avoid the odours arising from these so-called

inlets in front of the intercepting trap, tenants have on their own account stopped up the opening, and under the circumstances, in my opinion, they are quite justified in doing so.

Closely connected with this question is that of the ventilation of drains and sewers. I have been somewhat surprised to find that many surveyors at the present time are recommending the ventilation of sewers up houses on private ground. Such a proceeding is—as, I believe, I have shown on other occasions—attended with considerable danger to health; and I wish to enter here a protest against a method which I believe to be utterly wrong in principle, and tends to distract public attention from the real source of the nuisance, and palliates an evil, instead of removing it.

It is common knowledge that nearly all newly-laid sewers on the separate system, if they be ventilated by ventilators at the crown of the road, are, when first put into operation a nuisance to the public. It is equally well known, I believe, that the cause of this nuisance is the stagnation of sewage, the deposition of solids in some portion of the sewer, consequent putrefaction, and the production of offensive gases, so that when a sewer gives offence to the nose it is a sign that it is not doing what it was intended to do, viz., carry fresh sewage, which in itself is always inoffensive. When this state of things occurs the public demands that the nuisance be abated. Owing to the very large number of schemes which have been completed of late in the smaller towns and rural districts these complaints have become quite common, and there has been a tendency, which I consider to be unscientific, to endeavour to remove the nuisance from the nose, instead of removing the cause which produces it.

It is no part of my subject to-day to deal with this question as it refers to public sewers, but I do wish to take this opportunity of entering my protest against some of the systems which are officially being carried out, and notably that which instead of preventing the formation of noxious gases tends to bottle them up, and discharge them some few feet above the roofs of private houses. I have on a previous occasion shown instances where, I believe, a system similar to this has been productive of suffering and death, and I may say that acting on my advice in a neighbouring town, for which I act as medical officer of health, all ventilators of sewers up private houses have been removed by the Corporation.

It is to be regretted that in considering a question of this kind the matter should be treated as one belonging only to the department of the surveyor. In matters sanitary, as in other professional matters, no doubt there is a tendency at the present time to specialize unduly, but while it is the duty of the sanitary

engineer to formulate and carry out a system for the removal of sewage and waste waters, it is no reason why the medical side of the question should be forgotten, and I maintain that this can only be definitely and properly settled by the harmonious working of medical and engineering experts. In this matter of ventilation of sewers it is no doubt comparatively easy to abate the nuisance as far as the nose is concerned, but I think in the past we have been too ready to forget the real meaning of the proverb that the remedy may be worse than the disease.

[*For discussion on this paper, see page* 595.]

"*Combined Drainage: Its pros and cons*," *by* JOSEPH PRIESTLEY, B.A., M.D., D.P.H.

(FELLOW).

ABSTRACT.

THERE has recently been such difficulty in connection with combined drains, which are "sewers" in the present state of the law, and therefore works for which the sanitary authority is liable as to repairing or relaying, owing to the combinations not having received at the time of construction the formal approval, sanction, order, or direction of the sanitary authority concerned, that there is a tendency to-day to look askance at and refuse all plans of drainage showing a combined system. Of recent years, too, sanitary authorities have had to expend thousands and thousands of pounds upon combined drains, so that they feel justified in insisting upon a separate drain to each house or building. Such an extreme view is unwarranted, as all sanitarians are agreed that a first principle in drainage is to keep the drains as far as possible outside, so that, in the event of defects in connection with the drains, no harm shall result to the occupiers by the escape of sewer or drain gas—a condition of things which may, and does, arise even in these days of expert drain laying, as the result of settlements, &c.

Detached and semi-detached houses ought to have a separate drain to each house, the drains being kept easily outside. In the case of a row or terrace of houses, a back line of drainage

should be provided, discharging into a branch sewer in a side roadway, or turning into the sewer in the roadway in front, either through an open uncovered passage-way between two adjacent houses (and not less than five feet for the width of such passage-way), or by the side of one house, or even, where necessary—a very rare occasion—through and under one of the houses. By branching each house separately into this back line of drainage all drains are kept outside, or at the worst, one house only has a drain running under and through it; whereas, if a separate drain and separate connection into the main sewer is insisted upon, each house must have a drain underneath and through it.

How many houses ought to be allowed on a combined drain? In practice I would restrict the number to six (or fewer), and have the combined drain itself intercepted and ventilated as a whole; but with more than six houses, the main drain ought to be regarded as a "sewer," and treated accordingly—each house drain being separately intercepted therefrom and ventilated.

In the very exceptional cases, where the combined drain has to pass under a house, the greatest care must be taken in laying the same, *e.g.*, manhole back and front, joints absolutely air and water-tight, drain (if not iron) embedded in concrete, intercepting trap provided, &c.

As to the Law. In the Metropolis, with which I am concerned officially, the judgment in the recent case of Appleyard *v.* the Lambeth Vestry, has laid down the law very simply. Section 74 of the Metropolis Local Management Act, 1855, allows a combined system which has, previous to laying, received the formal sanction of the Vestry or District Board concerned; whilst Section 17 of the Metropolis Local Management (Amendment) Act of 1862, extends the powers of the previous Act beyond Vestries and District Boards (which were created in 1856) to Metropolitan Commissioners of Sewers, who came into existence in 1848. Prior to that date, all combined drains constructed are, in London, "sewers," repairable by the Sanitary Authorities—a very large order. The new Public Health (London) Act, 1891, gives no definition of the word "drain."

In districts governed by the Public Health Act 1875, a combined drain receiving the drainage of two or more houses is a "sewer," repairable by the sanitary authority, but the Public Health Acts Amendment Act 1890 (Section 19 of Part I.), gives the sanitary authority power to deal with a combined system belonging to different owners, and to recover the expenses incurred in dealing with such combination under Section 41 of the 1875 Act. The 1890 Act is permissive.

Conclusions:—(1) Where a scheme of drainage is simplified,

and the drains kept outside, by means of a combined system (or even in the rare case when the combined drain has to be taken through and under one house), it ought to be allowed, instead of insisting upon a separate drain, passing through and under each house—such a combined system being best hygienically, financially, and otherwise. (2) When six (or fewer) houses are combined, the combined drain is to be intercepted and ventilated separately as a whole, but where more than six houses join, the main drain had better be treated as a "sewer," and each house separately intercepted therefrom and ventilated —the main drain itself not being intercepted, except in the rare instance where such main drain passes through and under a house or building.

Tabulated Statement as to 35 Metropolitan Districts.

Five (*i.e.*, 14·3 per cent.) do not allow, or approve, of combined drainage—two in connection with new, and three with new or old, buildings.

Thirty (*i.e.*, 85·7 per cent.) allow, and approve of combined drainage.

The only districts that disapprove of, and do not allow, combined drainage are :—

1. In new or old buildings: Fulham, St. George's, Hanover Square, St. Martin's-in-the-Fields.
2. In new buildings only: Clerkenwell and Bermondsey.

The districts that approve of, and allow, combined drainage are :—

Conditionally.—Camberwell, Whitechapel, St. Marylebone, Holborn, Newington, St. George-the-Martyr, Kensington, Clapham, Rotherhithe, Chelsea, St. Olave's, St. Pancras, Islington, Hammersmith, Strand, Westminster, Paddington, Hampstead, Streatham, St. James', St. Luke, St. Giles', St. George's-in-the-East.

Unconditionally.—Hackney, Shoreditch, Bethnal Green, Wandsworth, Limehouse, Woolwich, Poplar.

[*This Discussion applies to the papers by* Prof. BOSTOCK HILL *and* Dr. J. PRIESTLEY.]

THE PRESIDENT OF THE SECTION (Mr. W. Henman) said that it was very gratifying to find it · recognized among those

taking note of sanitary matters in regard to drainage, that serious evils arose from the use of intercepting traps, which in the aggregate retained large quantities of putrescent matter in the near vicinity of dwellings, and retarded the flow of sewage to the outfall. He strongly objected to the "Model" Bye-laws of the Local Government Board. In his opinion the employment of the word "Model," having regard to the present indefinite knowledge respecting sanitation, was injudicious and misleading. "Models" should be the best of their kind, which these Bye-laws were far from being. He hoped a strong feeling would be expressed by the Congress upon the subject of Bye-laws relating to sanitation. It would be well if the majority of such were relegated to the waste paper basket, so that sensible ones might be introduced.

Mr. T. J. Perry (Camberwell) ventured to differ from the views expressed by Dr. Priestley concerning the drainage question. He had been strongly opposed to the principle of combined drainage, which was costing the parish of Camberwell at the rate of £5,000 per annum. Dr. Priestley said a combined drain might very well go under one house. He dissented from that entirely. In fairness and equity it would be grossly unjust for him to insist on his drainage running under his neighbour's house or across his neighbour's garden, when in the ordinary way he could put it under his own. What now, however, he wished to hear was some scheme which he thought the President would have foreshadowed, some remedy to these evils. The subject had been discussed by another conference and by learned men, but they had failed to come to a conclusion as to what a drain or a sewer really was. They would therefore see how difficult it was to obviate the evil. They, in London, had tried in many ways to overcome the difficulty but they had no finality. There was nothing easier in the world than to condemn and pull up what other men constructed, but it was most difficult to construct something better, and therefore he would like to see some alternative.

Mr. E. M. Close (St. Pancras) wished to add his views on the matter. Although they might not adopt them or think them right, they might help forward the discussion. His belief was that the present system of drainage was entirely wrong, so far as traps outside were concerned. Traps inside were certainly necessary. The sewerage system of large towns was of course entirely different from that dealt with in the smaller villages mentioned in one of the papers, and if they had a sewer four or five feet high, they must get a deposit: and consequently get an amount of sewer gas in it. It was, therefore, absolutely necessary that the sewer should be ventilated. This showed that each house should have an interceptor trap, and that a pipe not less than four inches in diameter should be connected to the drain on the sewer side of the interceptor, carried to the top of the house at the most convenient point, thus each house would do its share of sewer ventilation. To compensate for this extra expense the so-called

fresh-air inlet should be abolished, also gully traps at foot of rain-water pipes. The rain-water pipes would then become ventilating pipes, and these with the usual ventilating pipes to the closets would keep up a free circulation of air all through. All matter discharged into a drain should run as freely and as quickly as possible to the sewer. He had never found a properly constructed, well ventilated drain offensive. The London County Council were about to issue new bye-laws, and he trusted they would be on the lines indicated in his remarks. The President had given them an excellent address, and the interest Architects now took in drainage questions stood in marked contrast to a not very distant time when such work was delegated to the builder's foreman, who in turn handed it over to the ordinary labourer, the Architect thinking such work far too objectionable and quite beneath his dignity.

Mr. T. Longdin (Warrington) said he was glad to know they were looking ahead. He spoke as a Borough Surveyor, and it would be very difficult to carry out the work they were called upon to do, especially if they had to abide by non-elastic Bye-laws. He was, therefore, glad to hear the model Bye-laws condemned, and he suggested that the question of Bye-laws be taken up by the Association of Municipal and County Engineers, and when they had come to one mind on the subject, they should let the Local Government Board know what the Association thought. Then there was the question of combined drainage. A set of plans are submitted for fifteen houses to be built showing the drainage. The Surveyor reports and his committee pass them as houses fit to be built with the drainage shown; afterwards the houses come into the possession of five or six people through Building Societies or otherwise. The drain which runs through the property becomes stopped and the owner is approached. He then replies "It is the duty of the man above me to attend to it: go to him." I think it is a very great hardship on the ratepayers if the cost of opening the drain for the benefit of private owners falls upon them. In Warrington they have back passages, and the private owners can drain through the passage, and those drains can then be used for the surface drainage when the passage has to be paved, and so prevent a dual system of drainage.

Mr. Councillor Campkin (Cambridge) desired to say a few words with regard to a statement in the second paper, as to the ventilation of sewers. That seemed to be one of the most difficult questions with which they had to deal at the present time, and he hoped that the outcome of this discussion might afford them information as sanitarians, as to some better system which they might adopt. He added that he happened to be Chairman of the Sewage Disposal Committee in Cambridge, and this ventilation question had been the most difficult with which they had to contend. In some parts of the town, the manholes had been an unmitigated nuisance and the cause

of constant complaints. Efforts had been made to remove it by frequent flushing, and, where ventilating shafts had been placed, these objectionable odours were removed, and he was sorry to hear that the system was condemned. So where was the remedy? Perhaps some gentlemen could give them an opinion on the question as to whether any ventilation of well constructed sewers was necessary at all, that is, assuming they secured proper inclination and a sufficient velocity. He was of opinion that much ventilation was unnecessary under such circumstances, because the sewage did not have time to collect or become stagnant and no nuisance arose because it passed along so rapidly. One however, could understand the necessity of ventilation of the old fashioned sewers, they being too large and consequently sluggish in flow, but he would like to know whether the ventilation was so absolutely necessary with regard to these modern sewers. They were told that unless there was ventilation, sewer gas was driven back into the houses and became a frequent cause of disease. A proper trapping and ventilation of the house drains would prevent that, and the sewers if they were self-cleansing should carry the sewage to the outlet in a few minutes. The sewage system, as regards disposal, was still in its infancy and some corporations would, he thought, find that they had spent money without material or satisfactory results.

Mr. Lewis Angell (West Ham) said Professor Hill had referred to what is a "drain" and what is a "sewer." Dr. Priestley had told them that miles and miles of sewers had been thrown upon the country which used to be maintained by private owners. Well, West Ham, which district he represented, had made representations to the Local Government Board to get the law altered in this respect, but without success. West Ham was known as a fighting corporation. They were in Parliament almost every year with omnibus bills, and they had a private Bill in Parliament this year with many clauses which they succeeded in passing. Whether Parliament was asleep or the Local Government Board nodding, he could not say, but they in West Ham had now reverted by their Act to the old arrangement, and could throw the cost of maintaining private drains upon the private owners. He would suggest to those present to recommend their authorities to go and do likewise, but, he added, they might not succeed.

A Delegate asked if the law was retrospective.

Mr. Angell replied that it was. He could not give the exact wording as he had not brought the Act with him. He thought, however, that it was not likely to become general over the country.

Mr. Sidney R. Lowcock (Birmingham) thought that "combined drain" was hardly the correct term for such drain, because the term combined drainage was generally used in connection with a system

which admitted rain-water to the sewers as well as sewage in contradistinction to the separate system. He liked Prof. Hill's definition better, "compound drain." Mr. Perry had asked for an alternative but it was impossible to produce an alternative which would suit all conditions, they had to suit their remedy to the disease. With properly designed and properly constructed sewers with air inlets and outlets at frequent intervals, no difficulties arose; the primary cause of the nuisance in almost every instance was that the sewers themselves were defective in some particular way. Another gentleman has asked that the Local Government By-laws should be amended; that he entirely agreed with. He also agreed with the suggestion made at the conference of Municipal and County Engineers the previous day that they should give the Local Government Board their assistance in such revision. They should however first decide what they wanted, for at present they were not agreed as so what the Local Government Board should do. He believed that a good many of the by-laws were obsolete and that was not to be wondered at, for when they were framed, engineers, surveyors, and sanitary inspectors, were not as educated as in the present day. He agreed with Prof. Hill that a multiplication of traps was to be avoided, but all traps should not be done away with. It looked very pretty in theory for the ventilator at the upper end of each house connection to ventilate its own little length of sewer as well as the house drain, but practically they would not work in that way at all. They could not control the motion of the sewer air in such a way. Sometimes the ventilators would act as inlets, sometimes as outlets, according to the temperature of the air, the direction of the wind, and the level of the district, and many other things, and what actually happened was that they got one or two ventilators ventilating the whole of the sewer. His opinion was that in compound drains the number of traps should be limited as far as possible, but they could not fix a definite number, such as one trap to each six or ten house connections, because that was an arrangement which must be made for each particular place. They were all agreed, he thought, as to the size of the drains being kept as small as possible. Prof. Hill spoke of a 6-in. pipe being insisted upon. He (Mr. Lowcock) some time ago found a 9-in. pipe insisted upon. A gentleman from Cambridge had asked if it was necessary to ventilate drains at all. He did not think he need say much about that; if he would just consider that the volume of sewage in any sewer varies continually and that as the depth increases the air displaced must find its way out, and as it decreases fresh air must find its way in, he would see that air outlets and inlets must be provided for this reason alone. In addition, even supposing the sewage could be conveyed away so quickly, as had been suggested, that it gave off no gases, which of course cannot be done, the sides of the sewers which are alternately wetted and dried, give off gases, outlets for which must be provided. Some people had an idea that ventilating a sewer meant blowing a hurricane through it. Nothing of the sort; so long as they could allow the different gases to enter and escape it was all that was required.

[illegible] thought they were all agreed [illegible] for combined [illegible] and one air-trap. [illegible] to lay down any [illegible] the local difficulties. [illegible] conditions, and [illegible] agreed that under the [illegible] that some outlet of [illegible] The way in which this should be [illegible] Personally, he rather [illegible] of such shafts should be a [illegible] He suggested that the Government should [illegible] under ordinary or difficult [illegible] various schemes, as A, B, C, [illegible] £100,000 or £50,000 [illegible] and scientific men. [illegible] would be money well spent, for [illegible] to a Local Authority, [illegible] would be most suitable [illegible] advice and direction would be [illegible] to the community at large.

[illegible] (Mr. William Henman) pointed out [illegible] before them was the [illegible] house drainage. What he [illegible] in his address was that they must [illegible] sewer gas is now largely [illegible] to dispose of it in a manner least [illegible] must be faced and every precaution [illegible] of sewer gas. On that direction they [illegible] He ventured to think the remedy [illegible] did not give off sewer gas, and a certain [illegible] Now with intercepting traps [illegible] gallons of filthy sewage matter remained [illegible] proximity to dwellings. The next flush passed [illegible] to produce sewer gas. Until [illegible] flushed and kept clean, it might be [illegible] against intercepting traps; in fact, as matters [illegible] compelled to employ them, and there [illegible] special reasons for their retention. [illegible] must, however, be abolished. It was not wise to lay down any "Model" system. Circumstances undoubtedly altered [illegible] should be treated on lines which experience [illegible] to be most suitable. All that had been said pointed to the [illegible] that sanitary requirements in matters of drainage were over[illegible] by law. The question as to whether a sewer was a drain, [illegible] a drain a sewer, was a mere legal quibble; but it very mater[illegible] affected the subject of drainage from a sanitary stand point. He [illegible] not advocate united drains for a number of houses, being pr[illegible]

property. He thought that the house drain should end at the boundary of the site appertaining to the house. Do away with the necessity for intercepting traps, and, although there would be little difference, except perhaps in size, between the drain and the sewer, there need be no question as to liability. Mr. Longdin had mentioned back passages. He (Mr. Henman) had had some experience of these in the North of England, but in Birmingham they rarely existed. In many respects back passages were an advantage, but there were evils connected with them. For the purpose of drainage no doubt the back passage was a most admirable arrangement, but they almost excluded the possibility of having gardens to the rear of the houses, and added considerably to public expenditure if maintained in a reasonably clean condition. Mr. Lowcock and another speaker had referred to the ventilation of sewers separate from drains. All turned upon the question of traps. Do away with the trap and there was no distinction between drain and sewer ventilation. If they ventilated the end of the drain to each house, and suitably adjusted the openings to the sewers in the streets, he ventured to say that air would almost invariably enter at the street level and be emitted at the higher outlets. The generally higher temperature in the sewers and drains than that of the outside atmosphere would naturally cause an upward tendency; but, were traps abolished, there would be very little sewer gas to get rid of.

Prof. Bostock Hill (Birmingham) was gratified by the free discussion which had followed the papers. The points that had been made were, many of them, very important, and it would take far more time than he had at his disposal to reply. He would, however, reply to some that stood out more prominently than the rest. To the opinion expressed by Dr. Priestley as to drainage under the house, he absolutely disagreed. He did not think that under any conditions, except in premises they could not alter, any drain should go underneath the house at all. He preferred to see all the evils and he believed they were considerable—of the separate a sopposed to the compound drains—rather than that one house should take the drainage of other houses in the neighbourhood. He thought that as regards ventilation the whole subject may be summed up by the President's observation that fresh sewage does not smell. If they could always be sure that their drains were carrying fresh sewage and that they did not have stale sewage, then they would have the problem solved. He contended that they should not attempt to cover up the existing conditions, but should go to the root of the matter, if possible—and he believed it was possible in many instances —by ascertaining where the deposit was, and then take measures to get rid of it He had had many opportunities of seeing conditions such as he had been speaking of. He remembered one sewer which was not only offensive, it had got into a sort of switchback condition, and close to every man-hole the sewers were more or less occluded

with stinking filth. Would it have been proper to cover up these manholes? Mr. Willcox was called in and what he did was a proper thing, and that was to re-construct the sewer (although the expense was great), and he removed the nuisance. Mr. Day had suggested certain exhaust shafts and destructors for sewer gas. They had many of these brought under their notice, and many of them claimed this and that, but if they looked to the principle of the matter they found it was wrong. They could not in a large town get such a draught on the sewer as would consume the gases, and even if practicable, the expense of doing so would be absolutely prohibitive, He went further, however, and said they did not want to do it. They needed to make arrangements so that they would not have these offensive sewers. They did not wish to quibble over the point just because judges had decided that what was considered a drain was a sewer. They wanted to do their work in such a way that the public might benefit from it. He thought he could not be accused of holding socialistic views, but when the tendency of the State was to step in and remove ashes and night-soil, he could not see where there should be the difficulty of the State doing something in the way of remedying drainage conditions for people who could not help themselves. He considered, further, that it would be a great advantage to the community if it were to be more of a principle for all drains to be looked after by the State, and kept in such a condition that they were not injurious to health.

Dr. J. PRIESTLEY (Lambeth) replying, said Dr. Bostock Hill had practically gone over the ground, and had helped to make clear what he (Dr. Priestley) had also endeavoured to make clear in his paper. Referring to the question of combined or compound drains, he contended it was better for a combined drain to pass under one house than for a number of houses to have each a separate drain running through and underneath. He wished they could get adopted in connection with London what his colleagues in the provinces had, viz., an Act like the Public Health (Amendment) Act, 1890, under Part I., of which were offered ways and means of contracting out of liabilities in respect of combined drains, which were found to be defective and to require repair.

"*Sewage Disposal in Connection with Tidal Waters*," by H. Bertram Nichols, Assoc.M.Inst.C.E.

(Member.)

The majority of the coast towns discharge the crude sewage into the sea or tidal estuary. It occurred to the author of this paper that a few particulars and statistics relating to what has been done in some of the principal sea-side towns would be of interest.

Unlike inland towns where it is essential to adopt either irrigation, chemical precipitation, or some one of the well-known methods of treatment in conjunction with land, sea-coast towns are under the distinct advantage of being able to readily get rid of their sewage without undue cost of disposal.

The author has made enquiries as to the various methods of sewage disposal in the principal sea-side towns of this country, and from his own acquaintance of coast-towns he has prepared the following tabulated statement, setting forth the methods of treatment adopted and the points of discharge into tidal waters.

Name of Town.	Tidal River or Sea.	Is Sewage Stored during Rising Tides? and method of Storage.	Method of Treatment and Point of Discharge.
Aberystwith.	Tidal River.	Yes; in Tank sewer, capacity 140,000 gallons.	Outlet to River, in mid-stream 300 yards from low water.
Birkenhead.	Tidal Estuary	....	Crude sewage discharged to low water spring tides.
Bideford.	Tidal River.	Yes; in Culvert.	Outlet sealed by water in River.
Boston (Lincs.)	Tidal River.	Yes; the lower end of sewer being of large capacity to allow for storage.	To low water spring tides in the channel of the River; the two outfall sewers have been in existence for many years. Volume of tidal water large compared with sewage.
Brighton.	Sea.	Yes, in Intercepting sewer.	Outlet carried to low water spring tides.
Beaumaris.	Menai Straits	No.	Ditto.
Bournemouth.	Sea.	No.	Outlet carried to 25 feet below outfall discharge.
Bexhill.	Sea.	Yes, in Tanks.	Outlet carried to low water spring tides.
Carnarvon.	Menai Straits	No; but sewage backs up into Culvert.	Ditto.

Name of Town.	Tidal River or Sea.	Is Sewage Stored during Rising Tides? and method of Storage.	Method of Treatment and Point of Discharge.
Cleethorpes.	Sea.	Sewage held up by incoming tides in main outfall sewers. (In contemplation to provide storage by Tanks or Culverts.)	Two outfalls, one carried to low water spring tides.
Colchester.	Tidal River.	Precipitation in Tanks.	Lime and Alumina ferric; discharge into River Colne at all states of the tide.
Chester.	Tidal Waters.	Partly, in Tanks.	Lime; outlet carried to low water spring tides, discharged on ebb tide.
Dover.	Sea.	Yes, in Culvert.	Below low water.
Devonport.	Sea.	No.	Outlet carried to low water spring tides.
Eastbourne.	Sea.	No.	Outlet carried to one point below low water spring tides.
Falmouth.	Sea.	Settling Tanks in duplicate, with upright strainers. Process the the same at all states of the tide.	Sulphate of Alumina and Lime; outlet carried to low water; sludge taken by Hopper into Bay.
Felixstowe.	Tidal River.	Yes, in Tanks.	Discharge 1½ hours before low water, and 1½ hours after, with outlet pipe 15 ft. under water at low water spring tides.
Great Yarmouth	Tidal River.	Partly, in enlarged Sewers.	There are 40 outlets into River Yare, the principal outfalls being below low water.
Grimsby.	Tidal Basin.	Yes, in Culvert.	In contemplation to continue the outlet to low water; at present the discharge is above low water mark.
Gosport.	Sea.	No.	Several outlets into Portsmouth Harbour. (A Precipitation scheme is proposed, with outlet carried into the Solent below low water.)
Gateshead.	Sea.	No.	Not carried to low water spring tides.
Harwich.	Sea.	Yes, in Storage Sewer.	Discharge an hour after high water: outlet 100 yards beyond low water mark, extreme end in 22 ft. of water at low tide.

Name of Town.	Tidal River or Sea.	Is Sewage Stored during Rising Tides? and method of Storage.	Method of Treatment and Point of Discharge.
Hartlepool.	Sea.	No, except for one small district of 900 population which is stored in Culvert.	Outlet carried to low water spring tides.
Hastings.	Sea.	Yes, in Tanks.	Outlet carried to low water spring tides.
Ipswich.	Tidal River.	Yes, Tanks in duplicate.	Roughly filtered through screens; outlet carried to low water spring tides.
King's Lynn.	Tidal River.	Yes, in Culvert.	None.
Neath.	Tidal River.	Yes, in enlarged outfall Sewers, calculated to contain the inflow during the period the outfalls are tide-locked.	Outlet from 2 ft. to 4 ft. above low water.
Newhaven.	Tidal River.	Yes, in Culvert.	Sludge deposited in separate chamber, and outlet carried to low water.
Newport (Mon.)	Tidal River (deep and swift).	Sewers of large capacity, which act as reservoirs about two hours daily during spring tides.	Several outlets on both sides of the River Usk, not carried to low water spring tides.
Newcastle-upon-Tyne.	Tidal River.	No.	Outlets in same cases carried to low water, but usually to half-tide level.
Penzance.	Sea.	No.	Discharge by three outlets, two of them carried to low water spring tides, the third not quite to low water.
Poole.	Sea.	No.	Outlet carried beyond low water spring tides, discharge in 15 ft. of water.
Ryde (I.W.).	Sea.	Headed up by the sea in the Sewers.	Discharge at two points, where there is a depth of 6 ft. at low water spring tides.
Sunderland.	Tidal River and Sea.	No.	Many of the outlets are carried to low water, others to about half-tide level, and others to points varying between these two levels.
Stockton.	Tidal River.	Partly.	One-half of the sewage is received into a Settling Tank near to the outfall previous to discharge.
Teignmouth.	Tidal River.	Yes, in Tank.	Outlet carried to low water

Name of Town.	Tidal River or Sea.	Is Sewage Stored during Rising Tides? and method of Storing.	Method of Treatment and Point of Discharge.
Torquay.	Sea.	No.	Outlet carried to low water spring tides.
Workington.	Sea.	No; sewers tide-locked some hours during each day.	Outlet carried to near low water spring tides.
Worthing.	Sea.	Yes, in open Tanks.	Outlet carried to low water spring tides.

From the above tabulated statement, it will be seen that the towns on tidal waters generally discharge the crude sewage into the sea or tidal river, with the outlets at or below low water of ordinary spring tides.

In several cases the sewerage schemes were carried out many years ago, and the probability is, in some instances, if the same schemes were placed before the Local Government Board for sanction at the present time, they would be rejected in consequence of provision not being made for satisfactory treatment of the sewage before its discharge.

It is always necessary that float experiments should be made to define as nearly as possible the set of the currents near the shore in connection with sewerage schemes for all towns and districts situated on tidal waters; and it is becoming now a question as to whether it is not desirable to at least clarify the sewage before its discharge. Where the currents have a tendency to set back and leave floating matter on the foreshore some provision should be made both for storage and treatment, and the question arises as to what form the storage should take, under what system the sewage should be treated, and under what conditions it should be turned into tidal waters.

Many towns adopt the method of storing the sewage in a culvert or intercepting sewer, but local conditions to a great extent affect this question, it being advisable in some cases to store the sewage in an underground storage tank.

The crude sewage in most sea-side towns is let out at points a little below low water on the receding tides, and the principal towns on tidal waters are so situated that the sewage is discharged and carried well out to sea before the tidal return.

Where oyster beds flourish on tidal waters, as in the river Colne, below Colchester, great detriment to this industry might arise by the authorities permitting the crude sewage to continue to discharge at all states of the tide into the river, and in such cases, and also with respect to cockle beds situated

on the coasts, the author is of opinion that where the sewer outlet is necessitated within the vicinity of these beds, the sewage should be stored and also treated by some satisfactory method; afterwards being discharged only on the receding tide.

Clarification of the sewage is not enough where the volume of the sewage is great in comparison with the flow of a tidal river. Under such conditions it is advisable that the sewage should be specially filtered through coke breeze, clinker, or other suitable materials of sufficient area and capacity, or passed through land before final discharge.

The removal of the sludge becomes an important factor where there is a likelihood of any sewage matter returning to the beach, and in some cases this is accomplished by interception in large catchpits before entering the outfall culvert or tank. In other cases it can be taken out to sea, as at Falmouth, where the sludge is taken by Hopper into the bay.

Sea-side watering places and health resorts of course have to be particularly careful as to the point of discharge of their sewers, especially where sea-bathing is participated in, and it has become essential that the sewer outlets shall be carried to low water of spring tides and to points where the currents set out to sea.

The author has arrived at the following general conclusions: that only where there is a rapid seaward current is it permissable to discharge the crude sewage into tidal waters, and then only on the receding tides. Where float experiments, over a lengthened period, show that there is a likelihood of sewage matter returning to the point of outlet, or being carried on to the foreshore, it is advisable for the sewage to be treated. In the majority of cases, clarification is all that is necessary, and this can be accomplished by precipitation in tanks, or on the biological principle as adopted at Exeter and other places.

To ensure perfect immunity from danger, however, the outlets should always be carried to points where the currents tend seaward.

Mr. William Baker (President of the Clerk of Works Association, Portsmouth) said he was sorry to see that the author of the paper had left out of the schedule the important town of Portsmouth, where they had an excellent system of sewage collection and disposal. It had been his pleasure to superintend the whole of the new works that had recently been carried out from the designs of Messrs. Bramwell and Harris, the Engineers for the work; and within two years after their completion the death rate had been lowered to about one-half of what it had been for many years past, and that low rate had been

maintained ever since. He understood the author of the paper to say that sewage should only be turned out on a spring-tide. Would it, he asked, be stored up during neap tides? Explaining their system in Portsmouth, Mr. Baker said their outlet valves were opened by the release of the sewage itself, which passed through turbines and set well-proportioned gear in motion, lifting the heavy outlet valves and the sewage was let go to sea on the top of every tide; and in fifteen minutes after the outlet valves were closed the sea had its normal appearance. Many bushels of shell fish were taken off their outfall pipes, sold by fish hawkers and consumed by the people of Portsmouth. As to ventilation, the Engineers were compelled by the Admiralty and the War Office, who carefully watched all their doings, to construct a shaft 80 feet high with a furnace at its bottom continually burning, through which the foul air from the sewage tank passed.

Mr. Sidney R. Lowcock (Birmingham) said he had not intended to make any remarks on the paper as they in the Midlands had little opportunity of seeing seaside sewerage. Some years ago, however, he was engaged in the enquiry by a Royal Commission into the pollution of the Thames by the Metropolitan sewage, and he thought perhaps his experience might be of interest. They carried out float experiments for many months, and found in some cases that the sewage which was discharged did not find its way out to sea for many weeks. It went up the river as far as Chiswick, and for five or six weeks floated backwards and forwards. That was a frequent occurrence, and if there was not sufficient oxygen in the water into which the sewage was discharged, the sewage did not get broken down and created a nuisance. A very important point in connection with float experiments was to use the right kind of floats, as otherwise the results obtained were absolutely erroneous and misleading.

Mr. Arthur J. Martin (Exeter) said there was no doubt that where sewage was sent into tidal water it was advisable to remove the solids. There was one point connected with the question which the reader of the paper had not drawn attention to, and that was the enormous difficulties met with where large volumes of surface water were admitted to the sewers. In a town near Exeter they had carried out a system of sewerage at great cost, and now a new system was wanted on account of land drainage and surface water causing floods in the lower parts of the town. It was therefore important in seaside towns to intercept as much of the surface water as possible at a high level, so that it might be discharged continuously above high water. It was common to put in a storage sewer to receive the sewage during the rising tide, but this was inadvisable where a storage tank could be constructed, for it was better that the deposit of solids should take place in a limited area where it was accessible than in a great length of sewer from which it was almost impossible to dislodge it. The great trouble usually found in seaside places was

in the matter of ventilation. The necessity for ventilation arose not only from the generation of foul gases, but also from the fact that they had in the sewers a varying volume of sewage. The result of the rise of the sewage in the sewer must be to displace a large volume of air, and unless great care was exercised they would have a great nuisance. In the town already referred to the ventilators or manholes were termed smelling-bottles, and he confessed they deserved the title. He thought it was desirable that where possible the discharge of the sewage should be arranged to be governed automatically by the rise and fall of the tide. The ordinary tide-flap was an attempt in this direction, but the disadvantage of the ordinary tide-flap was that so long as the water outside was below the level of the sewage inside, no matter whether the tide was rising or falling, an outflow would take place. Attention should therefore be given to the necessity of providing automatic means for regulating the discharge of the sewage.

Dr. F. Vacher (Birkenhead) also added his thanks to the author of the paper, for gathering together such a large amount of information, and placing it before the Congress. Coming from a town situated on an estuary, where the practice had been to put the contents of the sewer into the estuary, he could tell them that dealing with sewage in this rough and ready way was not satisfactory. Even if the sewage were turned out on a receding tide, it at times floated to and fro just about the harbour bar, and it might be a long time before it disappeared at sea. It was so manifest to the authorities at Birkenhead, some time since, that the sand in the estuary was getting foul, that Dr. Vacher was requested to report upon the matter. In five or six samples of sand examined he found sewage in every one, and some of the samples of sand were taken as remote as he could get from the sewer outlets. Many years ago in the course of a visit to the United States, he stayed a few days at Boston, and found that the same conditions obtained there. Sailing past the mud banks, he supposed for an hour or two, he found bank after bank more or less foul from sewage or refuse. He could, he said, mention other towns where pretty much the same conditions existed, and the result of his experience had been to impress upon his mind the fact that it was not a safe or wise course for any district simply to put its sewage into the estuary. In every instance sewage should be treated in some way before it was put into the estuary. There were two ways well suited for the treatment of sewage—one, the modern method of dealing with it in biological filter beds, and putting the effluent into the estuary; and another, that adopted in Edinburgh, of running the sewage over meadows, and discharging a good effluent only into tidal waters. What he strongly objected to was treating it with aluminoferric or lime, or anything which created a great amount of sludge.

Mr. Moss Flower (Bristol) had the same complaint as another speaker that Bristol had not been included in the Paper. He said

they had a number of outlets into the river Avon at Bristol which was a very nice river when the tide was in, but a very nasty one when it was out. They made no attempt to ventilate the sewers and the result was that nuisances existed in many parts of the town, but it would be ridiculous to attempt to ventilate many of the sewers until they had been reconstructed. It was now proposed to spend £350,000 to £400,000 to make the necessary improvements in the sewers. He himself lived at Portishead, a few miles out of Bristol, and they packed all their sewage into the sea without any preparation whatever, and they were pretty certain no nuisance would arise from this. They had got over the difficulty caused by having many of their sewers below high water by the introduction of the Shone system. They had a normal rise and fall of something like 36 to 38 feet, and with the introduction of lifting plant at Portishead they could dispose of the sewage probably for years without resort to tanks. If it was found necessary to have tanks they would adopt them, and the main outfall sewer had been arranged with this object in view. He then detailed float experiments he had conducted, showing the necessity of following the floats to determine the course and the currents. Had they fixed the point of emptying the refuse into the sea 100 yards nearer the shore they would have encountered the currents, and the sewage would have been set back upon the shore, causing a serious nuisance.

Mr. Charles J. Jenkin (Willenhall) described float experiments at Llandudno in North Wales. Floats of the usual "sunk" description placed at the sewer outfall on the commencement of the flood tide at first trended inshore, but in every case finally found their way to the open sea. They tried "postcard bottles," but these were found on the Lancashire coast about a week after; and in no case did they come in on the North Wales Coast. He might say that the fish in the vicinity of the outfall were there in millions. In relation to the non-treatment of the sewage, he said he had been out many times, and he had never seen any sewage on the foreshore.

Mr. Rushton (Cleethorpes) said, in answer to Mr. Nichols, with respect to the indisposition of the L. G. B. to sanction outfalls into the estuaries, &c., if some of the authorities had now to apply for powers which they had already obtained they would probably be refused. Mr. Rushton said that their new outfall was laid down in 1893, and float experiments were carried out, and the floats followed and then anchored down. After the cholera outbreak at Grimsby and Cleethorpes in 1893, and the agitation over the alleged contamination of the oyster beds and oyster layings in Grimsby Docks, the L. G. B. sent down Dr. Bulstrode to inspect the oyster beds. At very low tide, when the beds are almost bare, they (the beds) show all to be very clean, the water clear, and no mud or slime appeared on the stones and divisions marking out the various beds. Samples of water were taken by myself from over and off the oyster beds, at all states of the tide, the water was analysed by Dr. Muter of

London, and nothing in the nature of sewage was found. The two outfalls are discharged right out into the middle of the bay, and the sand banks prevent the sewage coming back on to the shore. There are three valves on each outfall, so if the first or the second valve failed to act, the third was there; the foreman went down every two weeks to oil the valves and remove any obstructions that found their way into the valve boxes, and to instance the necessity of such inspection, one day the foreman found two "lard buckets" in the boxes. Cleethorpes suffered from its proximity to Grimsby in many instances; for instance, if any thing occurred at Grimsby, people at once jumped to the conclusion that it was of necessity at Cleethorpes also; the oyster layings at Grimsby were not at all a fit place for laying oysters, *vide* L. G. B., report on "Oyster Culture in relation to Disease, for 1894–95." In the same report no direct charge is made against the Cleethorpes outfalls, and from an extended personal knowledge of the Cleethorpes beds, he had not the slightest hesitation in saying the beds were as good as any in England.

Mr. W. J. Gilliland (Belfast) pointed out that although his own city had 300,000 inhabitants it was not included in the list. They had been discharging crude sewage into the estuary of Belfast Lough and it had been found most unsatisfactory, the foreshore for some distance having become very evil smelling, and one result had been a serious outbreak of typhoid fever attributable at least to some extent to the eating of cockles gathered from the banks subjected to the sewage deposit. A number of the members of the Belfast Fire Brigade as well as private individuals were attacked, and it was clearly traced to this cause.

Mr. Councillor T. H. Smith (Blackpool) said they had obtained powers to discharge the sewage of Blackpool further out to sea, *i.e.*, below low water mark. One difficulty to be met was the necessity of finding storage for their sewage during the time the outlet was tide-locked. To meet this difficulty they had constructed a large chamber and impounded the sewage therein, but they had found great difficulty because after some time the tidal valve at the outlet did not act, and the sea water found its way into the chamber provided to accommodate the sewage. But in any case whilst the sewage was collecting in the chamber the gases contained therein, the so-called sewer gas, must be displaced, and it would find its way out at the nearest available opening. To avoid this it was decided to pump air constantly from this chamber by a large fan connected therewith by a 2 ft. pipe, and to deliver the gases so extracted underneath the fire-bars of the destructor cells. This not only cleared out the air from the sewage chamber better than had been anticipated, but had also increased greatly the efficiency of the destructor.

Mr. J. Munce (Belfast) said whilst Mr. Gilliland was a free lance he (the speaker) was an official, and had to be more careful in his utterances. It was a more difficult matter to deal with twelve

[illegible] mentioned by [illegible] the foreshore of [illegible] condition, and blamed the [illegible] to tell them that the [illegible] a mile from the shore on every [illegible] complained of the sewage [illegible] channel leading to the [illegible] off the banks to the [illegible] Belfast was to store the sewage in a [illegible] hours after high water [illegible] to open the penstocks for [illegible] the sewage was discharged on [illegible] three hours to flow seaward [illegible] The tide flowed fully four miles up the [illegible] and consequently the sewage [illegible] before the tide turned by the [illegible] after the discharge from the tank [illegible] of the intercepting sewers and tank, [illegible] at the lowest state of the tide, [illegible] into the harbour, but now the harbour is [illegible] and fish are caught where the cross [illegible] There was no doubt the foreshore [illegible] at times from the large [illegible] by certain winds and allowed to [illegible] changed the mass disappeared and [illegible] The officials who were responsible were [illegible] on the health of the town and [illegible] was not sewage deposit. The sewage [illegible] barracks, near Holywood, and of the [illegible] discharged on the foreshore at low tide, yet [illegible] whilst Belfast Town Council was [illegible] in deep water at high tide. The [illegible] openings in the arches, about 2 ft. 6 in. [illegible] just like surface ventilators [illegible] however, was that after all to discharge [illegible] current of an estuary [illegible] ratepayers best in the long run. [illegible] had been gravely proposed would [illegible] increase in the rates.

Mr. [illegible] (Westminster) said there had been [illegible] who had touched upon the question of fish in water [illegible] sewage was discharged. He would like to know how se[illegible] [illegible] whether there were certain kinds of fish [illegible] [illegible] sewage, or whether sewage tended to [illegible] [illegible] in its neighbourhood. If this latter were [illegible] it became a very serious matter, as fish formed a large [illegible] important article of food. Also whether typhoid had ever [illegible] communicated by the eating of fish, other than shell-fish, that [illegible] been in water contaminated by sewage. They had just hear[illegible]

cockles communicating typhoid, and there are many instances on record of oysters having done so; but as to the question whether fish thrived in estuaries into which sewage was discharged, he had heard that trout were particularly fine in a river that ran alongside of a churchyard.

Mr. William Henman (the President of the Section) said that to avoid back flooding at high tides in seaside sewerage schemes there should be a lifting power capable of keeping the sewers perfectly free from tidal effects. Sewers of such large capacity would not then be required. In listening to the remarks of previous speakers, it occurred to him that while at Freshwater some years since he noticed a very unpleasant smell for a day or two, and found it came from the sewer discharge into the Bay. Previously there had been a spell of dry weather, and he noticed on the beach what appeared to be a considerable number of grains of rice, which in reality were grubs of flies, and he was informed by the boatmen they always had them in dry hot weather, and that when rain came they and the smell would soon be gone. This he found was the case, and instead of the grubs and the smell there was a number of flies who evidently fed on the decaying animal matter from which the unpleasant smell arose. Movement appeared to be necessary for the development of active life, for wherever there was stagnation in air or water, healthy growth did not fully take place. He simply referred to these observations, not knowing if any useful lesson might be derived from them, for time did not permit him to pursue the subject.

Mr. H. B. Nichols (Birmingham), replying to the comments on his paper, said he did not include even all the principal towns of the Kingdom enumerated in his paper at the request of the President, on account of the length the paper would take. He was most pleased that there had been so much discussion on the matter. The question had been raised as to the kind of float which it was best to use in these experiments. He had found the float about three feet long which would stand out of the water about nine inches, with a flag painted black, the best. But experiments varied and did not apply in every case. As regards putting down bottles he had come to the conclusion that they were useless, and he showed this by relating the result of experiments on the Lancashire coast, for some of the bottles which were advertised for at half-a-crown reward were found months after. This was very unsatisfactory to the Local Government Board. His own idea was, with regard to these experiments, to carefully follow the floats to the point where they turned and follow the turn as far as possible. He thought it was the general opinion of engineers that surface water should be excluded from all sewage disposal works. He thought that that, generally speaking, was the reply to the discussion that had taken place.

"*Some Sanitary Defects in Rural Districts with Suggestions for their Remedy*," *by* GEO. H. SMITH, P.A.S.I.

(MEMBER.)

I PROPOSE briefly to bring under your notice some of the principal defects, from the sanitary point of view, of rural life, and then to submit for your discussion some of the remedies that have been suggested for them, in the hope that greater interest may be awakened and action speedily taken in this most important subject.

In the Reports of the Medical Inspectors of the Local Government Board one of the most frequent matters complained of in rural districts is the water supply, and yet how terribly slow are the local authorities in taking action.

The usual sources of dietetic water in the country are three in number, viz.: shallow wells, the rivers, and the ponds. The shallow wells are perhaps the largest source of supply. They are usually sunk in the garden attached to the house, often without steining, seldom provided with protection from surface pollution, and rarely cleaned out. The cesspool is generally in the same plot of land, and not unfrequently geologically above the well and within fifty feet of it, and of course not watertight, in fact the chief advantage of a cesspool in the eyes of a villager is that it seldom requires emptying. The dangers here, especially when dry seasons occur, when the action of the pump, where there is one, tends to draw in the soakage from the cesspool, are obvious to all of you.

The rivers as they pass through the villages generally receive the drainage directly or indirectly from some houses, as well as the surface washings from the roads and cultivated lands: where they run through pastures, the cattle are often to be found standing in them, and in the case of small streams dipping ponds for sheep washing are frequently constructed across them, yet polluted as they are they provide the sole source of potable water for many houses.

Ponds are open to the same polluting sources as the rivers, and with more serious effects, there being no self-purifying action taking place with them as is the case with rivers; the water is stagnant and affords a good breeding place for frogs and other reptiles.

These defects admit of only one remedy—proper supply of pure water from waterworks wherever the houses are sufficiently close together to render it possible, and in other cases deep wells ought to be sunk and carefully guarded against pollution. The question of cost has here to be faced. The Public Health Act,

1875, Sec. 62, will not allow the water-rate to exceed twopence per week, and this limit raises great difficulties, but it would appear that the limit might well be raised to threepence without causing any hardship, and then much could be done as Mr. R. E. Middleton has shown in a paper read before the Surveyors' Institution in 1895. What is really wanted is a water supply judiciously designed, simple and inexpensive in working, providing about 10 or 12 gallons per head per day. We do not want in country districts a water supply for fire extinguishing purposes, the present sources can provide for that. Another difficulty, which is being increasingly felt, is the present arrangement of parishes and districts in curious interwoven boundaries. A rearrangement is needed on the lines of the natural watersheds. If such boundaries were adopted water supplies would be greatly facilitated, and the pollution of rivers more easily prevented.

Rural Authorities are proverbially slow in carrying out sanitary improvements, and it would appear desirable for the Local Government Board to have power to compel a District Council to construct waterworks forthwith, after due public enquiry, on the complaint of their medical inspector.

With regard to drainage, this is in most rural districts unnecessary, except in the larger villages. An improvement on the present arrangement should be made by a compulsory use of earth closets or privies with a small moveable receptacle, and the adoption of a sub-irrigation scheme for slop water as recommended by Dr. G. V. Poore at the last Congress. Midden heaps should be absolutely abolished.

Where drainage works are required, flushing is generally necessary, and the treatment adopted for the sewage must be simple and working expenses low, and in these respects the septic tank of Mr. Cameron and the bacteria filters of Mr. Dibdin are very suitable.

The difficulties which beset the water supply question are great but they are small when compared with those which surround the housing problem. The agricultural depression has deprived many landowners, who would gladly build, of the means necessary for erecting cottages for their labourers, while the rent that an agricultural labourer can afford to pay is insufficient to attract the attention of the investor, the result is that overcrowding and insanitary conditions exist on all sides.

Take the average labourer's cottage and what do we find it? Drafty, damp, unventilated (unless there is a tile off or a pane of glass missing), low-pitched, unwholesome, ill-arranged rooms, dark and dangerous staircases, scarcely-waterproof roofs, a plastering in of holes or holes covered with several coats of

common arsenical papers, and the cottages supplied with sanitary conveniences of the most primitive type. In such conditions exist, for they can hardly be said to live in the ordinary sense of the word, a large proportion of the agricultural labourers of the country, who but for their healthy outdoor-work would probably more often fall victims to purely preventable disease and premature death.

It may be argued that cottages are in better condition now than they were thirty years ago before the passing of the 1875 Public Health Act. This is no doubt correct, but the detailed Reports of the Assistant Commissioners of the recent Labour Commission show the terrible prevalence of insanitary conditions in the present day.

Power has been given to Rural Sanitary Authorities to condemn dwellings unfit for habitation, by the 1875 Act, the Housing of the Working Classes Act, 1890; and the Public Health Amendment Act, 1890, but with the complicated machinery provided, and the general indifference or hostility of the majority of the Members of the Board, it is almost an impossibility to obtain a closing order, and should such be obtained the usual result is to overcrowd the neighbouring cottages with the families removed.

The most practical remedy, and the one which possesses a large amount of influential support already, is to grant power to the Parish Councils to obtain land and build cottages where they consider necessary, with money raised by the local rates. An interest of $2\frac{1}{2}$ or 3 per cent. could often be obtained on the amount so expended.

Another great step on the road to reform would be to make it a *sine quâ non* that all Sanitary Inspectors or Inspectors of Nuisances should possess this Institute's Certificate and be disqualified from holding any other office in conjunction with their Inspectorship. A minimum salary should also be fixed for the appointment.

Professor Henry Robinson wrote some years ago in his work on "Sewage Disposal":—"Parliament should enact that all houses let to the poorer class should fulfil certain minimum requirements as to drainage, water supply, ventilation, and other essentials. If a certificate from the Local Sanitary Authority was not forthcoming that these requirements had been complied with, the house should be deemed unfit for human habitation." This practical suggestion coming from so eminent an authority deserves more attention than it has received, and if strictly enforced would soon lead to an improvement, but, the author thinks, before the certificate is demanded, the Parish Councils should have power to build and the Inspectors be duly certificated,

or the result would probably be that nine-tenths of the cottages would be closed without provision for housing those turned out, or the certificates would be of no value.

The scandalous conditions under which fruit and hop-pickers are housed, or rather herded together, has been recently brought before public attention, both by the terrible events at Maidstone and the discussion at the Institute; it is therefore to be hoped that something will be done to secure for them healthy accommodation with the ordinary decencies of everyday life.

In conclusion, it should be stated that much useful information on this subject may be found in the "Progressive Review" for December, 1896, and in the "Economic Review" for January, April, and October, 1897. It is hoped that some remedy will be tried speedily to abolish the insanitary conditions which exist, and lie at the bottom of the Depopulation Problem of our Rural Districts, and are a serious and growing danger to our Public Health.

Mr. J. ALDERSEY DAVENPORT (Engineer, Rural District Council, Nantwich, Cheshire) opened the discussion, remarking that he thought all Mr. Smith had said was perfectly true and correct. The difficulty they had to deal with in rural districts in respect of water-supply by means of waterworks had been the long distances that the houses were apart, and the consequent great cost in laying mains to supply them with water, especially as the rate allowed by the Local Government Board of something like 2d. a week would form no adequate return upon the expenditure. It might be interesting if he mentioned how they got over the difficulty in the Nantwich Rural District to which he belonged. In an essentially rural district, they had supplied something like forty townships by means of water-mains, and something like 3500 houses, and each house had a tap inside. They had no stand-pipes whatever, and for those houses and townships they had provided a perfect and pure water supply. How had that been done? The difficulty was one that he saw was great, and it had been overcome by asking the assistance of the owners of property. The minimum water-rate that all those tenants paid was 2¼d. per week. That was fixed by the Local Government Board under the Public Health Water Act. It would not however pay the cost, so in addition a rate of a penny in the pound was taken from the township, and beyond that the various owners—whether great or small—whose property was supplied, paid the difference. The owners in fact covered the deficiency. What was possible in one district, he thought was possible in others, if only it was set about. With respect to the owners of property he might be asked how the District Council was secure with regard to their contributions. His answer was that there had been a difficulty sometimes with small men. Their guarantees might at times be of very little use, and when death robbed the Council of their larger and safer guarantors the

succeeding owner might not be willing to pay the guarantee. His Council had experienced these difficulties, but they had been obviated by an Act which was passed in the previous session of Parliament, "The District Councils Water Supply Facilities Act." By that Act the owners of property were enabled to give security to the District Council for the supply of water to their property. In this way the District Council was absolutely safe in undertaking these schemes. They had been going on these lines, small at first, for something like eighteen years. They are much more busy now, and at present he had in hand water schemes for about six townships, and the next week a Local Government Board Inquiry as to three was to be held. So he was not speaking of anything that might be possible, he was speaking of something that had been actually accomplished. They found that when people experienced the benefits of the water supply, one spoke to another about those benefits, and so they were encouraged to extend their works from township to township. All the townships he referred to were essentially rural. At the present time other townships were asking them for water, and they could not possibly deal with them within a reasonable time. And so the thing went on. He mentioned these matters to show how improved water supplies, and water works in rural districts, might, with a little tact, probably be accomplished in other districts.

Mr. H. Denham (Aberford) as the representative of a Rural District Council, observed that Mr. Smith had suggested certain remedies, but these, in his opinion, did not go far enough. Why should the difference or distinction be made between the rural district and the urban district or town council, so far as powers were concerned to get water? By-laws which were in force in one place ought to be in force in others. Mr. Smith had spoken about wells. He was aware that the Public Health Water Act had been passed, and the Public Health Water Act was defective. Therefore, if the powers were placed with the Local Government Board, as suggested by Mr. Smith, probably the working of the Act would be defective. If the Local Government Board would amend their Acts and give local authorities power, he had no doubt that councils in rural districts, at least his own district he could personally speak for, would be very glad to carry them out. In some parts of his districts they could not sink a well under £50; therefore, what was the use of the Local Government Board coming in that place with the Public Health Water Act, which only allows about £8 10s. or £13 to be spent in providing water in sinking a well in rural villages? None whatever. Where were they going to get a district to sink wells for the amount of money stipulated? Where were they going to get the supply for rural populations under the by-laws? It was awkward to draw water in rural district villages of 200 or 300 people, over a district of ten miles. The rates were not sufficient to allow it. If the Act was amended, or the law amended in such a way that would give the same power to rural district councils as to urban councils, then they could do their own work without going to the

Local Government Board. Give them powers and they would do it themselves. Then came the question about rivers. He should like to see an Act of Parliament passed, whereby some person was given the power to see that streams in various parts of the country were cleansed. It was well known that people living in rural parts had to go to those streams to get water to drink, such as it might be, sometimes pure, sometimes not. With regard to the scavenging of rural districts, this was a very big, and very curious piece of work to contend with. If they started to speak of scavenging a rural village, the people at once rose up in rebellion and said "Oh no, we want this for our gardens; you must not disturb it." Therefore, he said, they were short of the powers possessed by urban districts to enforce it without the sanction of the Local Government Board. If they wanted to do this or that, it was necessary to get their sanction; possibly they got it, probably not. He considered that in that respect they were entitled to the same powers as urban districts. It should not be "They may." The words should be "They shall." All urban districts and rural districts should do this thing, the scavenging, and in his opinion, the expense ought to be charged upon the district which benefited thereby. What he agitated for was that the by-laws in force in urban districts should be the same in rural districts; the same law that applied to urban districts ought to apply to rural districts. If they had this power there would be no difficulty about it in his district, consisting of forty-two townships; they should have no difficulty. His council would be only too glad if they could get the means of carrying out the work.

Mr. R. E. SMITH (London) reminded the section that recently a short correspondence in *The Times* on the question of housing, raised the point as to whether in purely rural districts it would not be better rather to encourage private enterprise in the way of building cottages, than to have them erected by public authorities, and that in rural districts a good deal might be done if the regulations of many of the authorities were somewhat relaxed to allow wooden cottages to be put up. It was practically possible to erect wooden cottages at considerably less cost than cottages that were built of brick or stone, and such cottages could be made perfectly comfortable and weather-tight. In towns, of course, it was absolutely impossible from the risk of fire to allow such constructions. In the neighbourhood of London from which he came, however, there were still many districts in which a very large number of wooden houses existed. In country places there did not seem to be any very sufficient reason why such structures should not be allowed. There was no doubt that they could be erected at very much less cost than more substantial buildings, and they would last a very considerable number of years, and if they were boarded outside and plastered inside, there appeared no really sufficient reason against the allowance of their erection. It certainly seemed desirable, from many points of view, that private enterprise should be encouraged rather than that the matter should be put in the hands of public authorities. It was a suggestion

that might be worthy of the consideration of certain local authorities—if such buildings should be erected in considerable numbers, it might be a partial solution of the difficulty of providing cheap houses for the working classes.

Mr. WILLIAM BLAND (Urmston) said he had had some experience with regard to the housing of the people in rural districts, and he did not think it would be a good policy to relax the sanitary requirements of a district in order to encourage the erection of wooden buildings, if such buildings were to be erected by private enterprise. There would, he thought, be some reason for the relaxation of our laws if the buildings were to be erected by, and remain under the government and care of the local authority, because there would be some guarantee that they would be let at a rental which would be commensurate with the cost of their erection. He had in his mind a typical illustration in the construction of the Manchester Ship Canal, where there were erected hundreds of wooden buildings for the accommodation of the navvies and their families, and he knew that numbers of private individuals, taking advantage of the example set them by the contractor, erected similar buildings upon land which they were able to get in close proximity to the Canal works, with the result that they were able to get the same rents, or even greater rents for those wooden erections than persons were getting for very considerably better accommodation, in properly constructed dwelling houses. Therefore he said it would be a wrong course of action for the Congress or anybody to advocate the withdrawal of those provisions of the Public Health Act, and the by-laws which the local authorities had the powers to insist upon, in order to allow private people to put up buildings which they knew would quickly get in an insanitary condition. He deplored, what he knew to be the fact while engaged in sanitary work, that there was great overcrowding in villages. He had known cases where couples had had to wait years before they could get married because they could not get houses to live in in their own village. He had known cases where houses had been closed and pulled down, and people had had no homes to go to, and had to crowd into other homes. The necessity for better houses and more of them in country villages was established, but the way of getting them, he thought, lay with the local authority carrying out the requirements of the Housing of the Working Classes Act. It ought to be a compulsory Act, and not a permissive one, for all rural districts.

Alderman COMPSTON (Rawtenstall) thought the difficulty in rural districts was not so much as between wooden buildings and more permanent buildings, as the difficulty of getting suitable sites at all with easy ground-rent and conditions.

Mr. JOHN D. WATSON (County of Aberdeen) did not quite agree with the reader of the paper in advocating the intervention of the Local Government Board. It seemed to him that a great deal more could be done, as the gentleman from Cheshire had said, by local

effort and by the education of the people. He represented a very large agricultural county (Aberdeen), and they had from 30 to 40 villages, and since the passing of the Local Government Act of 1889 (a year later than the one in England) they had formed no fewer than 21 water districts and 20 drainage districts. These had all been formed quietly and without any fuss whatever. Their method was exceedingly simple. If there was any difficulty about water supply one of the officials of the County was generally consulted, and the people were asked to sign a requisition. Ten signatures were quite sufficient to call upon the local authority to consider the case, and if the local authority thought that a good case had been made out, they instructed the engineer to prepare plans showing where water could be had, or where—in the case of drainage—a sewage disposal system could be carried out at a reasonable expense. A great deal depended upon that. A local authority was generally frightened in the initial stages by the cost, and if they could show to the authority that reasonably good work could be done for a reasonable rate, his experience was that they were quite willing to go on with it. As he had said, 21 water districts and 20 drainage districts had already been formed. When the local authority did not form a special district after they had been requested to do so by the ten ratepayers, it was within the right of the ratepayers to go to the Sheriff (in England the County Court Judge) and call upon him to revise the judgment of the local authority. In two cases they had had such appeals and in both cases the County Court Judge had reversed the judgment of the local authority, and special districts had been formed. It seemed to him that if work of the kind was gone about pretty much in the same way that there would not be the need for application to the Local Government Board. With regard to the money required for the construction of capital works it was not necessary for them to have the sanction of the Local Government Board at all. If a village was formed into a special district in the way he had described, and if the plans were approved by the Standing Joint Committee, and the County Council authorised by that Committee to construct the works and borrow money therefore, it was enough to go forward and borrow money from whoever would lend it on the security of the County. They had borrowed money from insurance companies and others without any difficulty at the rate of something like 3 per cent. Where they took the advantage of the 2¾ per cent. rate provided by the Public Works Loan Commissioners it was necessary for them to apply to the Local Government Board for their sanction, but they did not hold a public inquiry as in England, all they did was to find out in the first instance whether the works proposed were thoroughly good, and if they were so, and if they were also perfectly satisfied that the rate to be levied within the special district was equal to provide sufficient interest on the money borrowed, there was no difficulty about it. With regard to wooden houses, they had tried them in the County of Aberdeen, but did not approve of them, and they found on the whole that they were not cheap houses.

The President of the Section (Mr. Henman), before bringing the discussion to a close, expressed his opinion that questions of water supply, at all events for country places, were dealt with in too small a manner. Each district was supposed to look after itself, only subject to the County Councils. His experience of country districts was that the people of the locality are too often quite content with things as they are, and will not move unless some pressure is brought to bear upon them. Therefore, it seemed to him to be better that the County Council should act and not wait for district councils and parish councils to apply to them. But better still, the whole subject of the water supply of the country should be dealt with on a far larger and broader basis by the Government. In some districts a supply which was ample and pure at the time it was procured, had in the course of a few years become inadequate and contaminated in consequence of the population largely increasing. The rainfall in England was ample, and gathering grounds were available from which large supplies could be drawn. The whole country should be mapped out and lines of aqueducts constructed, principally with a view to the requirements of all the most populous localities; but in such a manner as to provide a supply to every town and village by one rate or another. It would be a vast undertaking, but far more satisfactory than the costly methods of procedure hitherto adopted. The whole population would benefit and there would be an end of the struggle between one locality and another for possession of coveted watersheds. With regard to Mr. E. Smith's remarks advocating the construction of wooden houses to meet the requirements of rural districts, he was sure they were made with the best intentions. Perhaps there are some districts in which wooden houses might be allowed, but they must always be regarded as temporary erections. He knew it was a fact that in some places wooden houses lasted for a considerable number of years in a sound condition, but as a rule they were not durable in this country. A Norwegian gentleman, who came to reside in the North of England, preferring the method of house construction to which he had been accustomed in his own country, had the whole of the material sent over from Norway, and the house was erected exactly as it would have been in that country. Within three or four years rot set in, and he (the speaker) believed it was anything but a pleasant place of abode. The fact is that most wooden buildings erected now-a-days are only intended to be temporary. They may suitably serve a certain purpose for a time, but they are often permitted to remain, and people live in them long after they can be considered in a suitable sanitary condition for human habitation.

Mr. G. H. Smith (Malden), in replying to the discussion, thanked all who had taken part for the kind way in which they had received the paper. One speaker said that he did not go far enough on the question of the by-laws in the country. To a great extent he agreed with that. If a house was not fit for habitation on account of its air space, the height of its rooms, bad drainage, and such like

in a town, no amount of isolation would ever make it fit in the country. Therefore the by-laws which condemned it in the town ought to be the same in the country and condemn it there. Several gentlemen, he thought, rather misunderstood him with regard to Local Government Board intervention. Where a Local Authority was prepared to carry out a water scheme he did not wish the Local Government Board to interfere. What he held was that where the Inspectors of the Local Government Board were so frequently reporting a particular district, and when the Local Authority refused or neglected to put in force a water scheme, then the Local Government Board ought to have the power to compel the local authority to carry it out forthwith. With regard to wooden houses, he pointed out that in his district the country labourers could not afford to pay more than very little for house rent, and if wooden houses were going to be put up, there must be a certain amount set aside every year for re-erection. These houses would not last many years, and they must provide a sinking fund to pay for them, and this would add to the rent they would require the labourer to pay. If in the first place they built a substantial brick cottage, it would last considerably longer than timber, and they would not require such a large sinking fund, and in consequence not so much in weekly rent. With regard to the requisition for water as practised in Scotland, he thought it might do very well in Scotland, but he was afraid in England such a thing would not take place. In agricultural districts here they had the labourers who were a large majority of the householders, and where they were all working for farmers—if the farmers were not inclined for the water supply, it might be taken for granted that the labourers would not be. It would not be worth their while to sign a requisition to the Sheriff, or they would soon be requested to remove to the next parish. It might be very good for Scotland, but not for England.

"*The Purchase of the Catchment Area as a Means of protecting the Sources of a Public Water Supply,*" *by* J. SPOTTISWOODE CAMERON, M.D., B.Sc., Medical Officer of Health, Leeds.

THE duty of cleansing wells, the honour given to well-borers, the many lawsuits on account of the diversion of springs, all testify to the importance the community have always in all countries attached to the sufficiency and, so far as their knowledge went, to the purity of common water supplies. The impounding of river and surface waters, their storage in reservoirs and tanks — interfering as it so frequently does with

private rights—is in this country almost impossible on any large scale, except by the exercise of special powers, only to be obtained from Act of Parliament.

All waterworks undertakers, whether sanitary authorities or others, are required by statute law to conform to certain conditions, and certain powers have been given to them for securing the purity of the water supply. The Waterworks Clauses Act of 1847 contains the more important of these provisions. These clauses, it will be remembered, were the consolidation into an Act of Sections, which it had been usual before that time to insert in private Acts. Certain of these clauses (18 to 27), restrictive in their nature, and applicable to mines, are incorporated with modifications by the Public Health Act, 1875, Support of Sewers (Amendment Act) 1883, into the sanitary Acts binding upon all authorities. One clause of the 1847 Act requires that the undertakers, whether a waterworks company or a sanitary authority, shall keep and provide in their pipes pure and wholesome water, sufficient for the domestic use of all the inhabitants of the town or district within the limits of the special Act. But this section (35), while requiring them to keep this pure water in their pipes, does not confer any special powers for so doing. Other sections of this 1847 Act, referring to protection of water, deal (54) with the provision of cisterns and cocks, enact penalties (55) on persons allowing such apparatus to get out of repair, give rights of repair and observation in regard to the structures, and protect the undertakers against waste.

More cognate, however, to the subject of this paper is Section 61, which makes it penal for anyone (1) to bathe, or wash or throw an animal into a stream, reservoir, aqueduct or other work belonging to the undertakers, to (2) throw any rubbish into or do any kind of washing in such stream, &c., to (3) cause the water of any sink, sewer or drain, steam engine, boiler or other filthy water belonging to him or under his control to run or be brought into any stream, etc., or do any other act whereby the water of the undertakers shall be fouled. The penalty for any offence against this section is limited to £5, but there is a recurring penalty of 20s. a day, should the last mentioned offence be continued. There are also other sections relating to protection against effluents from gas-works which I need not remind you of.*

* The further Act of 1863, dealing principally with the security of reservoirs, enabled the undertakers to cut off water supply where injury had been done, and increased the strength of the law in regard to waste or the fouling through the pipes, but practically left the powers of protection of the sources of supply, much as in the Waterworks Clauses Act of 1847.

It is therefore principally the 61st section of the 1847 Act that has to be relied upon by a waterworks authority as a means of protection against the fouling of the sources of supply. There are, it is true, certain provisions in the Rivers Pollution Prevention Act, 1876, dealing specially with sewage pollutions and mining or manufacturing effluents. But this Act is hampered by such restrictions as make it extremely difficult to administer against an old offender. With the exception of the ordinary public health powers for the abatement of nuisances, these are the only general enactments enabling water authorities to protect the purity of the water they supply, and the question naturally arises—are they sufficient?

While the 61st section practically prohibits personal bathing or the washing of an animal, of clothes, of skins, &c., or the throwing of dirt into a "water-course," it does not say exactly what a water-course is. In many of our upland districts a fairly pure water is collected from large areas of moor and pasture land. The whole surface of the hills sloping to the river basin is really part of the water catchment, but only certain habitual courses of water could be called streams. These hills are often steep, and practically anything put upon the land is liable to be carried down by the rain to the water-courses. The average farmer cannot be made to understand that the heap of manure from his mistal, shippon, or byre, the liquid from which is allowed to trickle over his land, can be in any way objected to by a water authority, and yet he generally selects for the site of his manure heap, if not the actual bank of the stream, some steeply sloping ground, which would in heavy rain contribute surface water to the neighbouring runnels.

The question then arises "does he in any way infringe this section?" He does not throw his rubbish into the stream, or reservoir, or aqueduct. The rain which passes over the ground, carrying with it some of the filth, is not, he would contend, exactly filthy water belonging to him or under his control, which he can be said to cause to run or be brought into the stream. He does not intentionally make a channel from his manure heap to the water-course. On the other hand, in a sort of half-hearted way, he will dig grips across the course of this liquid to keep it longer upon the land, and having done this he will consider that he has done all that can be required of him under the section.

The convenience attached to his house is generally placed in the garden a little away from the dwelling. Not unfrequently it is on some high bank, the surface water from which gravitates towards the stream, but this place, he will tell you, has been so

situated within the memory of man and he does not see how anybody can reasonably object to it. A wayside Inn receiving travellers and fishermen, who are not necessarily always exempt from infective disease, has a convenience of the kind mentioned, at the back, and the night soil has to be removed from the immediate neighbourhood of the trout stream. The person who removes it is not as careful of it as if it were refined gold, and if a little escapes from his wheel-barrow as he takes it away he will regard such an accident as of trifling consequence. But possibly with the march of civilization and increasing visits of fishermen the landlord places a water-closet for the convenience of his customers in an upper storey and conducts the pipes into the drain or the cesspool bordering upon the stream.

His cesspool is not supposed to have an overflow, and *is* supposed to be emptied on to the land at some distance from the stream, but what guarantee has the water consumer that such is really the case. Such conditions as I have described are not imaginary, but are drawn from fact. What power has the Waterworks Authority, say the Corporation of a neighbouring town, under the section, to get rid of this nuisance. If they catch the man emptying his filth into the river, they can go to the Rural Magistrates and ask to have him fined £5. If they find that he has made a distinct channel from his house to convey the slops to the stream they can do the same. In one instance, in the house attached to an almost disused flour mill, after remonstrance from the authority, the drain from a slop-sink at the front had been cut off from the stream, but it was afterwards found that a small gutter at the back had evidently been utilized instead for the conveyance of slops into the mill-lead, and thence of course into the stream. But who is to watch the family in this house to see that they send no foul liquids into the beck?

The authority have, I take it, no power to seal up these apertures, and to say, "Not only shall you not use them, but we shall take them away." A conviction could, of course, only be obtained against an offender by proving the actual commission of the offence. But the object of sanitary science surely is the prevention rather than the removal of nuisances; and I suggest that a water authority ought to have powers of entering upon premises, and making alterations of such premises, at their own expense, of such a character as shall make it easier for the occupiers to use them in a cleanly than in a dirty manner. The ordinary law does not give them such power.

It is not to be expected that a farmer living on the side of a stream which has been impounded for water works purposes

should himself go to the expense of re-arranging the position of his midden, or of his stable, or of making a small sewage farm for the slops from his house, and carrying such slops carefully over land, so that they may be purified before reaching the stream, and of doing this, moreover, in such a way that a heavy rainfall shall not carry any of the unpurified effluent directly into the water-courses.

The expenditure of money for such purposes is evidently one for the water consumer who comes into the valley and takes the water. I say advisedly that the farmer does not intentionally foul the water, and that in many cases it would be difficult to convict him of so doing, *a fortiori*, it would be impossible to make him provide necessary works, such that the lines of least resistance should be on the side of purity.

Many towns have experienced these difficulties, and the increasing stress laid by engineers and health officers upon the importance of having the supply of a large town not only pure but above suspicion, has driven some of them to seek to obtain not merely the right of catching comparatively pure water as it flows, but, by acquiring the rights of a landlord, to be able to make such structural alterations as may be necessary on the various farmsteads within their catchment area. Manchester, I believe, claims to be one of the first towns to have acquired the freehold of the catchment area of a new waterworks. I am told that they have done this around Thirlmere. They have also, I believe, acquired a strip of land along their Longdendale reservoirs.

Birmingham, I understand, has acquired the absolute ownership of the basin feeding the Elan and Claerwen, and Liverpool has also acquired the ownership of such of the land as is not common land feeding their reservoirs at Vyrnwy.

Leeds in the 1896–7 Session of Parliament applied for compulsory powers of purchase of a large portion of their catchment area in the Washburn Valley. The circumstances were a little unusual and may warrant a word or two about them. The Waterworks Committee had been aware for some time that there had been certain undesirable conditions in the farmsteads in the valley and had made various endeavours, in the first instance through the Local Authorities and afterwards through the West Riding Rivers Board, to bring pressure to bear upon the various occupiers of these places to prevent possible pollution. In a great many cases by mutual consent a re-arrangement of structure was made at the expense of the Leeds Corporation, but a few of the dangers were of such a nature that it was difficult to see how they could be averted without somewhat costly changes.

[illegible] the worst of the cases was carefully gone into with the [illegible] considering whether legal action should be taken under [illegible] powers, and we were advised that it would be difficult [illegible] conviction before rural justices on such evidence as it [illegible] furnish. About this time it was thought desir[illegible] further reservoirs higher up the valley, and [illegible] Engineer suggested that in going to Parliament [illegible] not only seek authority to acquire [illegible] for [illegible] reservoirs and the ground feeding [illegible] at the same time secure compulsory [illegible] purchase [illegible] margin along the side of the [illegible] existing reservoirs.

[illegible] went through its final [illegible] postpone the erection of [illegible] Committee were, however, [illegible] seeking the powers for [illegible] that the Leeds [illegible] it is the first Act in [illegible] the protection of [illegible] the construction of [illegible] easier in future for [illegible] existing reservoirs [illegible] Parliament and [illegible] purchase the land around these reservoirs, [illegible] of protecting the purity of their supply, although [illegible] intending to erect, upon such land, reservoirs or [illegible] works.

[illegible] evident that the owners [illegible] conforming to such [illegible] may choose to make. [illegible] The advantages are [illegible] that I [illegible] by enlarging upon them.

[illegible] said he had listened with great [illegible] and the only fault he could find [illegible] that the subject was looked at [illegible] hand, coming from the [illegible] aspect, and before the matter was [illegible] aspect. What might be [illegible] more difficult in the South [illegible] North might find things [illegible] North. In the North [illegible] gravitation schemes [illegible] open moorlands. That was to say [illegible] wealth, cheap land. He did not mean

cheap land in the neighbourhood of the population. Down South they did not find any large cities, with a solitary exception which did not matter at all. They found large towns, well-supplies, and a good deal of tilled land. It was very difficult with well-supplies to fix any precise limit to their gathering ground. The gathering ground might be very distant, and though often of course to a large extent fairly open land, yet very often might include valuable agricultural land. So there they meet with poorer Corporations and authorities to deal with the matter, and with more expensive land. That, of course, made it less easy to deal with the matter in the South than in the North. On the other hand, they down South had advantages. He thought they could deal with sewage more easily than they could in the North because the sewage was not quite so bad. He was not, of course, speaking of the sewage from Dr. Cameron's place, which he had seen and wondered at. Personally he should like this inquiry extended. He now lived in an area where they were in great difficulty, in a large town, a fairly wealthy town, but nothing like the city of Birmingham; only a third or a quarter the size. Their catchment area was more or less agricultural land and pasture land, and more or less inhabited, with various asylums, schools, and other institutions over it, and they were in some difficulty. It would be utterly impossible to buy their watershed, even London itself would have to think a little before it attempted such a thing. He thought that the method of protection might be done sometimes in other ways than by the actual buying of land, and that a point which Dr. Cameron had made (that water authorities should have a right to inspect what was going on over their watershed, and also in some cases to replace bad works by good to some extent at their own expense), would go a very great way; because the expense of doing these things was a comparatively small matter generally. It was very often a simple matter to put a house and farm in good order, and to see to the sewerage; and such work represented a very small percentage of the cost of a decent sized waterworks. In Croydon the Corporation had done something in that way, by extending their sewage scheme to outlying districts, in order to get over the risk of the water being polluted by the sewage of villages and institutions. The people as a rule were very glad to have a sewerage scheme, and on the other hand, the Corporation of Croydon were glad to free their watershed from any suspicion. But another difficulty came in. They did not know how far these sources of contamination reached. Sometimes they reached a very little distance, but other times a long way. So the question bristled with difficulties, but that was no reason why it should not be tackled. They often heard "Oh, these things cannot be done." He never believed in "Can't be done." No engineer should know what the word "can't" meant, and medical officers should help in the destruction of this improper word. The great thing was to consider the subject and see what could be done. Each county must take its own line, and he felt that the County Authorities, the County Councils, should have a great deal to say on this matter without reference perhaps to the central authority. The

central authority should intervene, in this as in other cases, where the local authority did not do their duty. His belief was that as a general rule they were fully inclined to do their duty, and would not want spurring on. The subject was becoming more urgent in various parts of the Kingdom, especially perhaps in the South. The sources of pollution were increasing, that was to say in places where they were not looked after; and the great thing was to stop any further increase of the sort when it could do damage. He often had the feeling that he should like to detail a part of the Local Government Board officers to stop damage done to water, rather than to stop new sources of water supply, because damage was done or might be done somewhere. If they could do something in that preventive way it would be a very good thing indeed.

The Rev. Dr. Cox (Chairman of the Brixworth District Council) wished to point to the difficulties found in the rural district to which he belonged, in the neighbourhood of Northampton. They had, in their district, a large reservoir which supplied the important borough of Northampton, and two-thirds of the catchment area was in their rural district, and one-third in another; and they were just in the midst of troubles pointed out by Dr. Cameron. The Northampton Borough Authorities, finding a certain amount of pollution in their reservoir, had been very anxious to put, through the Brixworth District Council, all possible sanitary powers into force. He had gone round the reservoir on more than one occasion, recently as chairman with their new Medical Officer of Health for the county (Dr. Paget), and with the Borough Engineer; and there they had found the difficulty of dealing with the matter which had been pointed out in connection with farmers. There were various ordinary nuisances of the farm and cattle type, which were not sufficiently grave for them to take into account if theirs were not a catchment area. In one particular case they found an important house where the drainage was very defective. In that special case they were only too glad to act, and to act promptly, because the nuisance was an active pollution of a small stream which was a feeder. But when the smaller matters were brought before their Council, which consisted to a considerable extent of farmers, very anxious to try and do their duty, they naturally felt that these complaints would never have been made if it had not been that the borough had laid hold of that part of their district as a catchment area for their reservoir. Therefore, they were almost unanimously in favour of doing nothing more than would have been done if that had not been a catchment area. He thought that on the whole that that was the right line to take. They believed that when Northampton laid down the reservoir they expended certain money upon the putting straight certain farm nuisances; and, that, if they were to carry out the thing thoroughly, the town authorities must do it themselves, because they were the people who had come down to the district, and the water supply was no advantage to the people of that district. It had not brought about any real collision between the two different bodies, but if

either party were awkward and litigious, serious difficulties might readily arise. Dr. Cameron's solution of the difficulty seemed to be the right one. He hoped that Northampton might possibly see their way to purchase the catchment area around the reservoir, which would relieve the district councils of a good deal of responsibility, and clear up the difficulty in the matter. For instance, Dr. Paget drew attention to the pollution from cattle who watered at a certain stream which was connected with one of their principal feeders; and he wanted the local authority to make proper watering places with timber or stone in various fields, in order to prevent this happening. The speaker thought it was only natural to expect the rural council to decline to do that. They said, "No, if this was to be done, it is to be done by the borough authority, because if we admit we have to do it there we shall have to do it throughout the whole of the rural district, and a very expensive thing it would be." They had sympathy with Northampton in the object they had in view, but as a Council they did not think they were entitled, because there was that catchment area, to take any other step than they ordinarily should when nuisances were pointed out. But they hoped in all those small matters Northampton would rise to the difficulty, and would make the necessary arrangements. A far better solution would be if Northampton and other boroughs could see their way towards becoming the purchasers of land, and therefore their own landlords; and as such they could make arrangements with farmers and tenants in the easiest possible way.

The President of the Section (Mr. Henman), in summing up the discussion, said it seemed to open out the means whereby the subject of sanitation might ramify into distant localities. If the knowledge they had on sanitary matters in cities and towns could, by means of the Councils of those places, be made known to those in distant neighbourhoods it might spread and grow. It was in the country and in detached places that sanitation was often so bad, and it would be a good thing if the action of the larger authorities could help the dwellers in outlying districts to a knowledge of what would benefit their health and well-being.

Dr. J. S. Cameron (Leeds), replying, suggested whether the question of the price of the land did enter so much into the matter as Mr. Whitaker was inclined to think? The land would not cease to have a value because it came into the hands of a Corporation. A Corporation could borrow money at some 2½ per cent., and although the investment might not give them a very large return on their outlay, the amount of loss need not necessarily be very great, and would be a mere trifle measured by the increased safety to the consumers of the water. He thought in regard to what Mr. Cox said, they should remember that while many waterworks plants had often been constructed a good many years ago, science had been going on growing, and water authorities were stricter now than they used to be as to what they would allow to be turned into

their streams. Things which were disregarded at one time, or regarded as of small import, were now looked upon as serious, and under these circumstances it was right that the people who got the benefit of the good resulting from the stricter view now taken should pay to some extent for the advantage they derived from the change, whether by a slight money loss as owners of the catchment, or by bearing the expense of alterations in farm steadings made for their advantage as water consumers.

"*Birmingham Water Scheme*," *by* JAMES MANSERGH, M.Inst. C.E.

(FELLOW.)

ABSTRACT.

IT may be of interest to the Members of the Congress to have brought before them the details of the large water scheme which the Corporation of Birmingham are now carrying out for the supply of the City with water from the Rivers Elan and Claerwen in Mid Wales.

The length of the aqueduct conveying the water to Birmingham will be 80 miles as compared with that of the Stockton and Middlesborough (35 miles), the Manchester Thirlmere (100 miles), and the Liverpool Vyrnwy (66 miles) (schemes all executed); and the proposed Welsh scheme for London (170 miles), projected by Sir Alexander Binnie.

By a comparison of the rain gauges which were established for a short period at several points upon the shed with the long-term gauge at Nant-gwillt on the lower part of the Elan Valley and others outside, it was determined that the mean annual fall of a long series of years upon the watershed might be taken at about 68 inches, and the average of three consecutive dry years at 55 inches. It is very usual to take 14 inches as the amount of evaporation, but in order to be on the safe side and allow amply for the loss by overflowing, 19 inches were deducted from the 55, leaving 36 as collectable by means of the reservoirs intended to be constructed. Further observations since the Bill was in Parliament have satisfied me that we may calculate on obtaining from the works 75 million gallons a day for supply, in addition to the 27 millions for compensation.

Considered geologically the whole of the watershed consists

of rocks of the Lower Silurian age, principally inferior slates, but in parts of very hard grits and conglomerates.

It is the presence of thick bands of the latter stretching across the Elan, at a place called Caban Côch, and resisting degradation, which has determined the position of the contraction in the sides of the valley, and rendered it eminently suitable for the location of a barrier dam.

The height of the wall to be built here was, after much consideration fixed at 122 feet above the bed of the river, 700 ft. above O.D. at this point, and the contents of the reservoir behind it will be nearly 8,000 million gallons. As compared with the height of this wall above the river, Vyrnwy (Liverpool works) is 85 feet, and the Thirlmere (Manchester works) 50 feet. The River Elan has in the part affected by this dam a rise of 30 feet in a mile, so that the 122-feet barrier backs the water up that valley 4 miles and up the Claerwen, which is somewhat steeper, about 2½ miles.

A unique feature in the scheme is the provision of what has been called a *submerged dam*, to be built across the Caban Côch reservoir at a point nearly a mile and a half above the main wall, and called Caregddu, its precise function being to hold the water up behind it high enough to charge the aqueduct conveying the water to Birmingham, leaving the water below available for compensation.

There are still very few stone dams of any great size in England, although many are to be found on the Continent of Europe. The Elan and Claerwen Valleys are, however, peculiarly adapted for such structures, the dam sites being all on rock practically to the surface, and plenty of stone for building at no great distance, the material for earth banks being, on the other hand, deficient.

The structure of all the walls in the Elan Valley will be identical in character; they are being formed of blocks of stone (*plums* as the men call them) practically unhewn, varying from 5 or 6 cwt. to as many tons in weight, built so as to avoid horizontal bedding planes but with good vertical bonding, and embedded in and surrounded by a matrix of high-class Portland cement concrete. Both the *up* and *down* stream faces are being finished with heavy broken-coursed and rock-faced grit or conglomerate blocks closely jointed. The stone weighs about 172 lbs. per cube foot and the concrete about 146, and we are aiming at getting a little more than half the total mass of *plums*, so that the finished weight of the dams shall be as nearly as possible 160 lbs. per cube foot. The design of the walls is such that no effective tensile strain can ever come upon their water faces, but if it did, the structures as put together will

resist a tensile strain of at least 12 tons per square foot. When the Caban reservoir is full the total water pressure against the exposed face of the dam will be about 60,000 tons. The work is being so built that there shall be no interstices in it, and that each dam when finished shall be to all intents and purposes a monolith, only removable by some great convulsion of nature. Without reckoning anything for the cohesibility of the structure, but only considering the *weight*, the factor of safety against overturning is from 3½ to 4 in.

The drainage area above Caban Côch is by far the largest that has been hitherto dealt with in this country in constructing works of this character. Deducting the reservoirs, the Manchester Thirlmere area is 11,000 acres, the Liverpool Vyrnwy 22,000, and this is 44,000. The provision to be made for passing flood waters during the execution of the works is consequently a very important matter. At the Caban it is quite within the range of probability that at the very height of a flood 700,000 cubic feet a minute may have to be dealt with.

In order to meet this contingency a concrete and timber stank was erected on the Breconshire side of the river to exclude the water, and thus allow of the excavation for the foundation of that end of the wall being got out and the Brecon culvert built. The wall has been carried up to 730 O.D., or 30 feet above the bed of the river, the water passing meanwhile along the left side of its old course.

A similar stank on the Radnor side is now completed, and the building of the wall and the Radnor culvert will follow in due course. Then a stank of concrete will be erected up to the level of 730, abutting against the wall at the upper and inner end of each culvert. This stank being finished, it will be possible to impound water behind it to the extent of 240 million gallons, and to charge the two culverts (which are 16 feet in diameter) under a head over the centre of 22 feet, and this combined storage and power of discharge through the culverts will enable us to pass a maximum flood without interfering with the conduct of the works. The excavation for the foundation of the central part between the culverts can then be got out, and the wall built between the two ends.

When the wall has been finished to its full height the inlet ends of the two culverts will be closed.

Whilst they are performing their function of passing the river in its normal state, and during floods, they are fitted with cast-iron trumpets or bell-mouthed inlets to facilitate the entrance of the water. At the proper time these castings will be removed, and the face-plate to which they are attached will then become the seating of a steel caisson, which will be lowered

into its place by means of guides previously fixed and drawn home so as to form a watertight junction by bolts inside. These doors or caissons are competent to bear the pressure due to a full reservoir, viz., *about* 560 *tons*, and under their protection the pipes with their valves will be laid in the culverts for conveying the compensation water to the measuring chambers outside. Afterwards each of the caissons will be reinforced by a mass of concrete and brickwork inside the culvert, so that there may be no risk of the perfect and permanent soundness and watertightness of the "*stop*." In connection with the measuring apparatus there will be self-recording gauges and testing chambers, and turbines driven by the compensation water actuating accumulator pumps for working the hydraulic valves and dynamos for electric lighting.

Before closing this much-condensed description of the general scheme and the works in the valley, I should like to say that out of the 45,562 acres of the collecting area, probably 40,000 consist of open mountain pasture or moor land carrying not more than one small sheep per acre.

At the inlet of the aqueduct there will be a tower containing the controlling valves and simple screens to keep out floating matters. The aqueduct goes immediately into tunnel, a mile and a quarter in length, through the Foel, and emerges on the side of the hill about 800 yards below the Caban dam. At about 4¼ miles it crosses over the Mid Wales Railway where that line is in tunnel, and at 5 miles under the river Wye, a little south of the small town of Rhayader. At 10 miles it passes the village of Nantmel, and at 17 goes under the Central Wales Railway at Dolau, where it enters a tunnel 4¼ miles long. At 26 miles it is just south of Knighton, that point being at the east end of another tunnel 2½ miles long. At 35 miles it crosses over the river Teme, south of Leintwardine, then runs along Bringwood Chase to just south of Ludlow, where it again crosses the Teme. At 52½ miles it is half a mile north of Cleobury Mortimer, and at 58 miles it crosses over the river Severn 3 miles north of Bewdley, where the pressure in the pipes will be about 240 lbs. on the square inch. At 63½ miles it is north of Wolverley, and at 68 close to Hagley, reaching the intended Frankley reservoir at 73 miles 54 chains.

In the length of the aqueduct there are

13½ miles of tunnel;
23 „ cut-and-cover; and
37¼ „ iron and steel pipes crossing valleys under pressure.
——
Total 73¾ miles.

In *tunnel* and *cut-and-cover* the structure consists of blue brick lining on a concrete backing so far as the invert and side wall are concerned, the arch being of concrete only.

This conduit is laid almost throughout with a fall of 1 in 4,000, or about 16 in. in a mile, the exception being in the long tunnels which have slightly better gradients.

In crossing valleys below the hydraulic gradient line the aqueduct will consist at first of two 42 inch cast iron or steel pipes, with a fall of 3 feet in a mile, or 1 in 1760. As the demand for water increases a third, fourth, fifth, and sixth pipe of similar size will be laid.

The Corporation having decided to undertake the construction of the reservoirs and the works in the valley under the direct administration of their own staff and without the intervention of contractors, the question arose of how the people were to be kept together in close proximity to the works, and it was answered by the erection of a village below Caban Côch with sufficient accommodation for about 1,000 people. The houses are of wood, and are built of different types to suit varying grades; thus, there are huts for officials, such as the missioner and schoolmaster, for gangers, for married workmen, and for navvy lodgers. It has not been unusual on public works to put twenty-four men into such a hut, sleeping in pairs in twelve beds, and where work was going on day and night. I believe there have been occasions when these beds have not had time to get cold. This, to say the least of it, is *not nice.* The committee needed no pressing from me to sanction the erection of the huts above described. In the larger the eight men sleep in one large room, but each man has his own separate cubicle and single bed.

Water is laid on under pressure throughout the village, the drainage system is as good as can be made, and there is a fire brigade.

There is a canteen where good beer and aerated waters are to be had at certain hours and under strict regulations; schools for infants and older children, with one male and two female teachers, these rooms being used on Sundays for religious services. There is also a large recreation hall, provided with gymnasium, games, writing facilities, and a circulating library, besides affording accommodation for concerts, theatrical entertainments, and this last winter a *ball.* In addition there are *baths* and wash-houses, and a general and accident hospital in the village, and another for infectious diseases far away up the hill-side.

THE PRESIDENT OF THE CONGRESS (Sir Joseph Fayrer) in proposing a vote of thanks to Mr. Mansergh said the subject, that had been brought before them with such accurate detail, was one that was not only interesting to every observer of nature and to every scientific person, but must be of surpassing interest to all the inhabitants of Birmingham. He congratulated the Congress inasmuch as this had formed a part of its proceedings, upon having the opportunity of listening to the great engineer who had devised these works and was carrying them on with such great skill. If one might venture to prophesy—and he thought his vaticinations in that respect were not likely to be discredited—the scheme would be a great success, it would be of infinite value to this great city, for it would give the people the inestimable benefit of a supply of pure water, in fact, it would be in every sense a boon and blessing to the city. Apart from description of the engineering works one could not help being struck by the information the author had given upon the social condition of the workmen and the arrangements made for the welfare and moral discipline and conduct of all the people who were engaged upon the works. As far as his knowledge of such matters went, no better arrangements, none perhaps so good, had ever been established under the Licensing Act. They had to thank Mr. Mansergh for that, as for much else of interest they had heard of. He himself was so ignorant upon such subjects that beyond expressing the profound admiration one feels for something one does not quite understand he would not pretend to say more. If, however, a subject could be made clear to the most ordinary intelligence it had been so that day in the eloquent paper.

THE PRESIDENT OF THE SECTION (Mr. W. Henman) seconded the resolution of thanks. He had, he said, in viewing the excellent illustrations, been impressed with the great difficulty there must have been in formulating a scheme among the vastnesses with which the promoters had to deal. The mind, which could imagine it was possible to convert that mountainous district into a vast reservoir, to construct those enormous dams, those great culverts, and so on, was no ordinary one. Knowing something of what it was to design and to look forward in imagination to what might in the future appear in material form, it astonished him to think that anybody was capable of realising the possibilities of such a wilderness, a wilderness in the sense that it was remote and in its natural wildness. One other thing impressed him, it was that communities are now willing to face the enormous expense of vast engineering feats to secure pure water supplies; yet after all, it was but a comparatively small quantity of water that each individual, or the community collectively drank. Did it ever occur to them to estimate the quantity of water which was required for drinking purposes, and what the cost per gallon would actually be when such heavy expenditure was incurred by going great distances to secure it from a pure source? He would like to take the opportunity, as

the Lord Mayor and several of the City Council were present, to direct attention to the fact that the many thousands of inhabitants in that great city every minute of their lives, by night as well as day, were drinking in vast volumes of atmospheric air, compared with which the amount of water used as drink is only as a drop in the ocean. What he desired to plead for was that expenditure was quite as necessary to be incurred to obtain pure air as it is to obtain pure water. It was a subject worthy of more consideration than it had hitherto received. The reader of the next paper (Dr. Barwise) would give them some particulars as to atmospheric impurities and of means for estimating the same.

The vote of thanks was carried with acclamation.

Mr. J. Mansergh (London) in reply thanked Sir Joseph Fayrer for his complimentary proposal, and his hearers for the hearty way in which it had been received. It had given him great pleasure to read the paper at this Congress in Birmingham. With regard to the difficulties incident to the designing and executing works of this character, referred to by the President, an engineer was always eager and proud to grapple with them. These physical difficulties were not always the most onerous that he and professional friends he saw before him, had to deal with. Their more serious troubles often arose with members of the public bodies by whom they were employed, and frequently the smaller the undertaking the greater the worry. He was happy to say that here he was working with a committee of gentlemen of the highest business capacity, whose confidence he was proud to possess, and whose chief aim was to secure for their constituents, the ratepayers of Birmingham, the best waterworks in the country at the least possible cost. During thirty-five years he had never had a pleasanter experience, and he was very grateful to his Chairman, Mr. Lawley Parker, and the other members of the committee for their constant courtesy and consideration.

"*Plenum Ventilation, in its application to Public Elementary Schools*," *by* S. Barwise, M.D.

(Fellow.)

Before dealing with the question of plenum ventilation I must trouble you with a few figures as to the composition of air.

Normal air contains ·4 parts per thousand of carbonic acid. Air that has been respired contains 4 per cent. carbonic acid. An adult man at each breath takes in 30 inches of air, and he breathes seventeen times in a minute. Expiring 510 cubic inches.

We may say then that an adult respires about 500 inches of air per minute, and this air is loaded with 4 per cent. carbonic

acid, *i.e.*, each adult produces 20 inches of carbonic acid in a minute, or ·6 of a cubic foot in an hour.

If we imagine a man to be in a closed room 1,000 feet capacity, the air in the room when he was put in contained ·4 cubic feet carbonic acid, and at the end of an hour the man will have added to the room ·6 per cubic feet carbonic acid; so that the air will thus contain one cubic foot of acid, and the carbonic acid in the air would be one part per thousand.

Numerous analyses of air have shown that when respiratory and impurity present in the air is such that the carbonic acid is more than ·6 per 1,000, the air is stuffy; when it contains as much as ·9 per 1,000 it produces headache, and it is injurious to live in. To dilute the ·6 of cubic feet given off by each adult it is necessary that he should be supplied with 3,000 cubic feet of air, a quantity which weighs about 2 cwt. If a man is in a room 1,000 feet capacity, the air must be changed therefore three times per hour. If he is in a room of 100 feet capacity the air must be changed thirty times per hour, and in reckoning the capacity of a room for ventilation purposes, no space above 12 feet from the floor need be considered.

When we remember that in new schools a floor space of 10 ft. only is provided, if we allow 2,000 cubic feet of air per child per hour, the air must be changed 16 times, which cannot be done without some mechanical arrangement. I shall make my remarks refer particularly to schools, but they apply equally to theatres, churches, and all buildings where the cubic space per head is less than 1,000 feet.

In the Code of Regulations for day schools issued by the Educational Department this year, it is laid down that *new* schools shall provide a minimum floor space of 10 square feet per child (I believe existing schools are allowed to have 8 feet), if we take the available air space as that within 12 feet of the floor, the cubic space per head is 120 feet; so that, to give 2,000 cubic feet of air per child per hour, the air would have to be changed sixteen times. Let us see how the advisers to the Education Department suggest this should be done. They have at the end of their Code a number of suggestions to architects. It runs as follows:—

"Apart from open windows and doors, there should be provision for copious inlet of fresh air; also for *outlet of foul air at the highest point of the room.* The best way of providing the latter is to build to each room a separate air-chimney, carried up the same stack with smoke flues. An outlet should have motive power by heat or *exhaust*, otherwise it will frequently act as a cold inlet. The principal point in all ventilation is to prevent stagnant air; particular expedients are only subsidiary

to this main direction. Inlets should provide a minimum of $2\frac{1}{2}$ square inches per child, and outlets a minimum of 2 inches."

I will call your attention, first of all, to the fact that the Regulations do not distinguish between artificial ventilation and mechanical ventilation. The same cubic space is permitted, whether the air is changed once an hour or twenty times. Apparently, those who drew up the regulation had never heard of, or, at any rate, had never seen, a school mechanically ventilated on the Plenum system, at any rate that there is such a system is not even hinted at. The best way, suggest the instructions, for providing an outlet is from the highest point of the room. If the air is warmed—and it should be before admitting it—the top of the room is the very worst place for the outlet.

The size of the air inlet is given at about $2\frac{1}{2}$ inches per child, so that to provide 2,000 cubic feet per hour the air will have to rush into the rooms through the ventilators at no less a velocity than 32 feet a second, a rate that would be dangerous and utterly impossible.

Knowing what the regulations of the Educational Department are, the small amount of cubic space, and, as a rule, the entire absence of any adequate means of ventilation, we cannot be surprised at the fearful results obtained on the examination of the air in schools in different parts of the country. In a report to the North-Eastern Sanitary Association by Dr. Bedson and Messrs. Lovibond and Severn, the carbonic acid in the Newcastle Grammar School is given at ·915 per 1,000. The Gateshead High School for boys gave ·885, while the girls' school gave ·82; the Orphan House gave 1·16; the Jubilee Board School gave ·723, and the number of bacteria to a litre was 18, while in the outside air they were only ·2. In the Snow Street Board School (with four ventilators in the ceiling), the carbonic acid was 2·41, and the number of bacteria 18·3. At the Industrial School the carbonic acid was ·83, and the bacteria 38·2. Dr. Reid, in his "Practical Sanitation," page 38, gives the following analyses of air in public elementary schools in Staffordshire:—

School.	CO_2 per 1000	*School.*	CO_2 per 1000
Seighford	1·4	Texall	2·2
Ellenhall	1·5	Gt. Haywood (Catholic)	2·2
Salt	1·7	Ranten	2·4
Hyde Lea	1·8	Hixon	2·5
Gt. Haywood (National)	1·9	Colwich	2·8
Fradswell	2·0	Haughton	3·0
Weston	2·0	Reckerscote	3·2
Stowe	2·1	Bradwell	3·2
Gayton	2·2	Berkswich	3·7

Dr. Wheatley gives the following table of the amount of carbonic acid in the air, and of the size of the inlets and of the outlets in seven of the public elementary schools in Blackburn.

	Square inches of inlet and outlet per head.	CO_2 per 1,000 of air.
School No. 1	6·48	2·0
" 2	2·88	1·0
" 3	2·88	2·3
" 4	2·16	1·6
" 5	7·92	1·5
" 6	—	2·1
" 7	6.48	1·4

The most valuable investigations I am aware of, however, are those of Dr. Scurfield, the medical officer of Sunderland; who by means of the ingenious and simple apparatus of Mr. Defries, has made 164 estimations of the carbonic acid in the Sunderland schools with the following results:—

	No. of observations.	Time School occupied.	CO_2 per 1,000
Board Schools.	114	1 hr. 36 m.	1·03
Denominational Schools.	50	1 hr. 36 m.	1·36

In this case the schools were occupied for about one hour and a half before the test was applied.

The estimation of CO_2 in the case of other schools gives similar results, and I think that everyone must admit that public elementary schools, at any rate, must be ventilated by mechanical means, either exhaust or plenum.

The system which fits most easily the requirements of the Department, is the exhaust system, but we will see what happens when this system is carried out.

1. The exhaust fan is placed somewhere in the ceiling; fresh air inlets, in the shape of open windows and Tobin's tubes, admit the air directly from the outside; the direction of the current of air is, as a rule, pointed upwards, so as not to blow directly on the children in the school. In the older schools no arrangements were made for warming the air admitted, so that windows and ventilators are kept as much closed as possible in the winter months, and no ventilation takes place; but if the air is warmed, what generally takes place under these circumstances is very well shown by Professor Shaw in his article on warming and ventilation in Stevenson and Murphy's "Treatise on Hygiene." In Fig. 40 he represents a lecture room at Cambridge with the outlet near the ceiling; the fresh air passes at once to the outlet, the air in the part of the room below the inlet remaining stagnant. I am glad to find that no

less an authority than Sir Douglas G
suggestion of the outlet for foul air being
of the room. On page 137 of his "Obse
struction of Healthy Dwellings," he wri
introducing warm air at the lower part of
and allowing it to escape at the top, was ill
E. Wood, of Harvard University, upon
prevailing at the same time in a hospital
The hourly supply of air per bed was 9,0
high temperature of the inflowing air ca
velocity. This velocity was soon lost. T
movement of air throughout the ward,
stagnation in the centre for a height of a
the floor, and also a comparative stagnati
the bed-heads and extending to the uppe
The CO_2 was also found to be increased in
"This example," continues Sir Douglas,
tion shafts should be so placed as to cause
such as effected by a fireplace." Fig. 27
shows very well the objections to the roof
142 the same authority writes: "Extract
take place from the lower part of the ro
remind you that there is nothing new in
the floor level. Sylvester, who ventila
County Asylum about fifty years ago, ex
near the floor level, and admitted the f
Sir Joshua Jebb and General Morin bot
lets, the latter in the French Chamber o
former using it for prisons. In fact, it is
anything approaching perfect diffusion in
the vacuum principle with top outlets,
thereby passed direct to the outlet, leav
behind.

2. Not only does a powerful exhaust in
with the fresh air admitted above the heads
unless the air inlets are kept wide open
size, the exhaust will cause an inrush of
doors and through the crevices in the wind
dangerous draughts.

3. Another objection is that, as the sch
vacuum, ground air, air from defective dr
lavatories and other objectionable sources is

Having pointed out some of the chief
exhaust system, it is time to consider the a
ventilating on the plenum plan. To do th
arrangements in use at one of the schools I

The Bolsover Colliery Company's Schools: Ventilation and Heating.—The ventilating and heating system was carried out by Messrs. Ashwell and Nesbitt, of Leicester. The fresh air is forced into the various class rooms, &c., in the building by means of a fan 4 feet 6 inches in diameter, driven by a small horizontal steam engine. The fan runs at the rate of about 300 revolutions per minute, and forces the air through air passages under the main hall floor, from which the wall flues in the class rooms are fed. The air forced into the building comes down a fresh air shaft, about 30 feet high, but before entering the wall flues in winter it passes over steam radiators.

By an arrangement of shutters, all the air for each room can pass through a battery, or only part, the remainder going in cold. By these means the temperature of the rooms can easily be regulated.

The steam for the fan is generated by a small 4 feet 6 inch Cornish boiler, fixed in basement below the large hall. The boiler feeds also the various steam batteries, and works at about 10 lbs. steam pressure per square inch. In the large hall the radiators are fixed on the floor at the wall sides, the air coming up flues from trunks below, and blowing through them.

The vitiated air is extracted by Louvre ventilators, fixed on the ridge and connected with outlets in the class rooms at the floor level, and also others 8 feet from the floor, which are opened when the gas is lighted at night. Of course, if ventilating gas burners or the electric light were adopted, this extra outlet would not be necessary. The outlets are formed in the walls and in the false roofs connecting up to the Louvre extractors. It is intended in the summer time to run the fan with a small gas engine. The position of the outlets was arrived at after careful experiments, and that best results are obtained by taking the air off at floor levels will be understood when one bears in mind the amount of filth, dust, and dirt that accumulates on the floor of a public elementary school. The vitiated air is therefore withdrawn just above the floor level and conveyed to upright exhaust shafts above the building.

With regard to the incoming air, it is warmed above 60 degrees, and being warmer than the air in the room, it spreads out over the upper part, where it is cooled by contact with the walls, and still more by the windows, and gradually descends down these cooler surfaces, and eddies across the room to the outlets. The whole air of the room is in a steady motion of about half an inch a second—a rate that cannot be felt, but can be seen by blowing smoke or chloride of ammonium fumes into the air.

Each class room is intended for fifty children. It has a floor space of 528 feet, and a cubic space of 8,400 feet. The air inlet is 6 feet 6 inches from the floor level.

Without informing anyone of my intention, I paid a visit to these schools, and measured the air being pumped in. I found it was entering through the inlet at the rate of 380 lineal feet a minute. This works out at 1,276 cubic feet of air per head per hour. A sample of the air in the same room, which was taken at 12 noon, when the children had been in since 9 a.m., gave ·57 parts of carbonic acid per 1,000, the outside air yielding ·4. Another similar class room, which had contained fifty bigger children, yielded ·59 parts of carbonic acid per 1,000. Parkes estimates the carbonic acid given off by a child as from ·25 to ·34 of a cubic foot per hour. If we take it as ·3, and the teacher at ·6, the carbonic acid at 12 o'clock should have been ·61 per 1000.

Perhaps the best examples I have ever seen of mechanically ventilated schools are the Melbourne Road and Clarendon Park Board Schools at Leicester. The former school has accommodation for 1,700 children. The fresh air is taken in at a shaft 12 feet high; it is then filtered through jute cloth, and propelled by an open-bladed fan, five feet in diameter, driven by a five-horse power gas engine, through the main air-conduit, which is six feet six inches high, five feet wide. This flue, which has been purposely made absolutely impervious (being constructed of concrete, with a cement face), is regularly cleaned and limewashed as soon as any signs of dirt appear. From the main duct up-cast shafts, in connection with which there are steam radiators, branch off, and enter the class-rooms eight feet from the floor. The outlets are near the floor, other outlets near the ceiling being provided for use during the short time the gas is lighted at night.

The cost of the gas, the oil, and the waste in working the fan is 6s. a week. I have measured the air passing into this school, and found it was about 1,000 cubic feet per head per hour. The carbonic acid in a class-room built for 60, but which contained 67 boys, was at 12 o'clock ·63 per 1,000.

At the Clarendon Park Infant School, the air supplied to each child worked out at over 1,000 cubic feet per hour; at 11 o'clock the carbonic acid was ·5 per 1,000. At both schools the area of inlet per head is about eight inches.

One of the latest schemes that I have heard of is for the ventilation of the City Road Board School in Birmingham, which is being ventilated by Mr. Key, of Glasgow; the contract here is to change the air eleven times each hour.

As an instance of the immense advantage of adopting an

dequate system of ventilation, I may say that I found when at Blackburn a case where, by adequately ventilating his weaving heds, a large manufacturer increased his output $2\frac{1}{4}$ per cent. This result he attributed entirely to the improved ventilation, and informed me that his expenditure on this head had been a wonderful investment.

I cannot conclude this subject without referring to Dr. Carnelly's classical report to the School Board of Dundee on the ventilation of schools. He points out as indirect evidence of the better health of teachers and scholars in mechanically ventilated schools than those in naturally ventilated ones, that the grant earned per head is more than 2s. 6d. higher in the former† than the latter.* The following table is condensed from Dr. Carnelly's report:—

	No. of Schools.	Average Grant Earned per head.	CO_2 per 1,000 parts.	Conditions of Air Micro-organisms per litre.
Mechanically ventilated Schools ...	9	21/-	*1·2	*17
Naturally ventilated Schools	95	18/3¼	†2·1	†97

The carbonic acid in the mechanically ventilated schools is about half that in the naturally ventilated ones, and the micro-organisms per litre are only $17\frac{1}{2}$ per cent. in the mechanically ventilated schools what they are in those naturally ventilated.

Carnelly sums up the question with the following recommendations:—For *new* schools mechanical ventilation should be employed (1) because it is more comfortable, the rooms being kept warmer and the temperature more uniform, whilst draughts are as far as possible avoided; (2) because it is much healthier, and prevents the spread of infectious diseases, owing to the children being supplied with purer air; (3) because by it the children are enabled to derive greater benefit from their education; (4) because it increases their grant-earning power without increasing the labour of earning the grant; and (5) because it increases the teaching power of the teacher."

Mr. Willis (Newark) referred to the Chairman's remarks that eople spent immense sums in procuring good water, but good air, always appeared to him, was of far more importance. In the case f children in schools, and employees in manufactories and work-

* 5 Schools. † 33 Schools.

shops there was nothing of greater importance. Most of his hearers, no doubt, were aware that tuberculosis in cows and animals had been traced to the want of pure air, among the cows especially, in confined sheds; that disease was transmitted to human beings very much by the milk, as was also well known, therefore it was of great importance to the milk supply that the animals supplying milk should be kept in a healthy state. Dr. Sims Woodhead in one of the other departments had told the audience that 50 per cent. of cows in the dairies of towns suffered from tuberculosis, and it was believed by the best authorities that tuberculosis was to a very large extent, if not almost entirely, caused by the foul condition of the air of the sheds in which the animals were kept. The cost of the ventilation of schools was a matter he should like to have heard something about. One was in difficulty there. First of all it was very difficult to persuade sanitary authorities, or school authorities either, to ventilate schools at all. They did not know it was of the least importance, but as Dr. Barwise had shown it was of the greatest importance. One wanted to know some practical means of dealing with the subject in small class schools at a reasonable cost, and would not excite the fear of the authorities who were responsible for the existence of those schools.

Mr. E. B. Marten (Stourbridge) proceeded to say that Dr. Barwise had given a most clear description of the principles involved, and the instrument he had introduced seemed exactly the thing to put into the hands of those who were not trained chemists to make the experiments themselves. But there was nothing at all to tell how the artificial draught was produced, or how it could be warmed. That was the first thing to consider when they had settled the scientific part of the question. It was thirty years ago that the Chairman of the Council, Sir Douglas Galton, described the first scheme by which he produced the plenum ventilation. In regard to barracks to which the system had been applied, he remembered the remark that the occupants could sit by the open window, while ventilation was being supplied by the special method, and there was no draught at all; and the soldiers instead of being round the fire would go to the window to sit in preference.

Mr. Shaddock (Westminster) said that he had listened to Dr. Barwise's paper with a vast amount of interest, and had been particularly struck with the description of an apparatus whereby any one could test the results obtained by this or any other method of ventilation. He had recently been to see a school in Westminster —he thought it was the first school of the London School Board which had been ventilated on the plenum system, and it was more or less an experiment, he referred to St. George's Row, Westminster. He was very much interested in the means that they adopted, and although he did not understand the matter technically it might perhaps be of interest if he described in a very few words what

he saw. There was a very large main duct, as they called it, going right under the school, along its whole length, and from that large duct or tunnel were taken smaller ducts to each room in the school, and there was a very big fan at the inlet of the large duct driving the air forward, through a screen, which filled up the whole of the duct. The screen was made of cocoanut fibre, and was doubled over a roller top and bottom. The bottom roller was in a trough, and through this trough water was run, the screen was slowly revolving all the time, driven by the same power that drove the fan. The air was thus forced through the screen, which of course took the water up in the interstices of its woven fibre, so as to form practically one sheet of water, and the air being driven through it, was deprived of all the dust and dirt which would otherwise have gone into the room, and as the screen revolved so the dust and dirt went through the trough of water and was washed away. Another thing which struck him was the inlet to each of the subsidiary ducts leading to the several rooms. Each duct was divided in two at the inlet, and the top part was filled with what would be called heat gills—he did not know whether hot air or hot water, hot water he supposed—and there was a shutter that could be operated from the room which that particular duct supplied. This shutter was only half the size of the whole duct, that was to say it was entirely shut to the part that contained the gills, or the open part through which the air went naturally. It was operated by a valve in the room that was fed by that duct, so the teacher or anyone else in the room could regulate the shutter and could send either all cold air in or all hot air through the gills, or regulate it to any warmth that was wished. That was a very important matter. A rather interesting test was carried out to show what was going on by putting a perfume and other things in the trough of water with the screen revolving in it. As soon as it was put in, or almost directly, the whole building was permeated with the perfumed air, and by running fresh water through again the perfume was cleared out—so that they could, at all events, prove ventilation going on.

Dr. Thomas Carr (Braintree) desired to ask Dr. Barwise if he could give any idea as to the cost. Those of them who were Medical Officers of Health and had to consider the question of ventilation in the Board and other Schools that were under their care always had to consider the question of expense. Dr. Barwise, he thought, had convinced all of them of the good results that could be obtained by the plenum method, but they had to consider the question of cost before they faced the school authorities or their Council, and a little fuller information would be acceptable.

Dr. Scurfield (Sunderland) pointed out that in all cases where they had a small amount of air space, the only way whereby they could give the air in that air space a sufficient change, would be by mechanical ventilation. Where they had a hospital with 2,000 cubic feet of air

air. In such schools they must have the air chan;
hour, to prevent the carbonic acid rising above 8]
the end of one hour and a half, and they could h:
seven times an hour by means of mechanical ve
thought there was a tendency, where mechani
adopted, to try to thin down the inevitable ex
wreck the whole system. He had seen at least (
mechanical ventilation was used where too much
of the fan. In another mechanically ventilated s
inspected, there was in the infants' part of the sc
an enormous down-draught, sometimes a down-d
drive the fan at 100 revolutions per minute when
connected from it. That was entirely due to tryi
expense. On some windy days this school had tc
case of Sunderland asylum again the system had
unsatisfactory arrangements of the outlets. Th
terminated in the space between the ceiling and t
fan was practically expected to drive the air thro
it drove the air up the inlet flues into the rooms,
flues into the space between the ceiling and the
the air had to find its way out through ridge tile
cost, he believed that Carnelly estimated that
thousand scholars the extra cost for interest and s
apparatus would be about £20 per annum, and
maintenance would also be about £20, which woul
cost of £40 a year for a school of a thousand scho
a calculation based on Carnelly's estimate, and foun
of mechanical ventilation for an average Sunder
mean an increase of the total annual expenses of ab
the air were only changed once oftener per hour b
by natural means, the extra expenditure would be

another, one School Board after another, one Hospital Committee after another, and last but not least the Local Government Board were beginning to realise that, in many public buildings, efficient ventilation was unattainable without mechanical means. Some of the speakers had asked what was the relative cost. To his mind that was really a question of efficiency or non-efficiency. It must be realised that a pure and ample supply of air could no more be obtained than could a pure and abundant water supply without adequate outlay for plant and maintenance, nevertheless by care in planning buildings to suit the requirements of ventilation, by suitably arranged air ducts and flues, and attention to other matters of detail it was undoubtedly possible to reduce the cost of working. Taking the figures Dr. Barwise had given, there would be propelled into the school he particularised 1,700,000 cubic feet of air per hour, for which it was stated a 5-horse power gas engine was required. Now at the General Hospital, Birmingham, 20,000,000 of cubic feet of air per hour were driven through the buildings by means of electric motors at an average expenditure of less than 20-horse power. Their Engineer, Mr. William Key, who was really responsible for the installation and to whom he gave credit for the admirable work carried out, estimated from previous experience that 35-horse power would be required, and the electric motors provided were laid down in accordance with his estimate, so that they had a reserve of 15-horse power. A similar result was made evident at the Handsworth Technical Schools, near to Birmingham, erected from his designs, the air supply required was for 2,000,000 cubic feet, for which Mr. Key provided a 10-horse power motor. They found however that a 5-horse power motor, which was temporarily employed, was sufficient for the purpose. There were other matters of great importance in regard to the question of cost. It was quite evident to him that the cubic capacity of rooms, particularly in schools, might be very materially reduced, if mechanical means for securing ventilation were introduced. By so reducing the size of the buildings the saving in cost might go towards improving the ventilating appliances and the outlay in warming them would be less. He did not shut his eyes to the fact that there were practical difficulties to be overcome when mechanical means for ventilation were employed. For schools and many other public buildings occupied for only a part of the day, the requirements were intermittent, a state of things differing from the requirements of hospitals, asylums, and such like buildings, which were occupied both day and night. The difficulties arose from variations in the temperature of the outer air. If in cold weather the heating arrangements were not kept on, when the buildings were unoccupied, then the walls, ceilings, floors, and furniture would become cold, and when heat was put on, condensation of moisture invariably took place. He therefore advised that, in buildings, only occupied occasionally, provision should be made for maintaining an even temperature within. Windows should never be opened in extreme degrees of temperature. Practically they did not

require to open the windows at all, but in ordinary weather it might be advisable to open windows to rooms, only occasionally occupied, so as to thoroughly air them without cost for motive power. It would however be simple waste to open windows with the ventilating appliances at work.

Dr. S. Barwise (Derby) in replying upon the discussion, said that it had been his endeavour to deal with the question from his own point of view, and not to presume to speak upon engineering matters, such as motors, and the construction of flues, but merely to deal with principles of the question. With regard to the flues, however, he might say this: the schemes which were failures were due to two things not being observed. First of all the flues should be big enough, which was seldom the case, and be capable of being cleansed. Second, they should also be so arranged that when the fan was not working, the current of air through the building would be in the same direction as when the fan was working.

The President of the Section (Mr. Henman) interposed to explain a matter, which, he said, did not seem quite clear in connection with the outlets. If Dr. Barwise had examined more closely buildings in which the plenum system had been properly applied, he would have realised that it would be impossible for a down draught to occur. By means of a diagram on the black-board, he sought to show the Section that with a suitably constructed flap arrangement at the outlets, there must always be a pressure from within and outwards. The flaps, he explained, were of American cloth, about 7 inches deep, so arranged that movement of the outer atmosphere could not affect the outflow.

"*On the Quantity of Water required for Domestic Flushing Purposes, the Influence of Intercepting Traps thereupon, and the Saving effected by the Use of the Waste-water Closets,*" *by* Charles Porter, M.D., D.P.H., Medical Officer of Health, County Borough of Stockport.

(Member.)

The water-carriage system of refuse disposal, which is yearly becoming increasingly prevalent throughout the country, aims at the cleanly and rapid removal through drains of excremental matter from the neighbourhood of dwellings. For its successful application and working, adequate flushing of water-closets and house drains is absolutely essential, in order to prevent the latter from becoming "nothing better than elongated cesspools charged with foul festering filth," as was shown to be the case at Maidstone. The recent Government Report on the typhoid

pidemic in that town tells us that half its 6,000 and odd houses have water-closets without any mechanical means of flushing, and that the Sanitary Authority's lamentable "failure of duty in this respect has led to the gravest consequences," a large number of the typhoid cases being officially ascribed to soil and air-pollution from blocked and defective drains. In advocating conversion to water-carriage we ought therefore to satisfy ourselves that the public health is protected from the results of such deficiencies, and with this object in view I was directed in April last by the Corporation of Stockport to ascertain experimentally the quantity of water required to efficiently flush a water-closet with drain and intercepting trap.

Upwards of 120 experiments were shortly afterwards carried out on the lines adopted by the Sanitary Institute in 1893, the apparatus used being the following:—

(*a*) Duckett's *Wash-down* Closet, with S-outgo, and afterwards a Unitas *Wash-out* Closet.

(*b*) Water-waste-preventing cistern graduated for 6, 4, 3½, 3, 2½, 2 and 1½ gallons, and connected to closet by 5 ft. of 1¼ in. vertical lead piping.

(*c*) 47 ft. of glazed earthenware 6 in. and 4 in. pipe drain, with puddle joints, and having a right-angled curve one pipe's length from closet outgo. In upper surface of each length of pipe was cut a slot 15 in. to 18 in. long and about 2 in. in width, for inspection purposes.

(*d*) Disconnecting traps (or "interceptors") of a good type, attached to end of drain, discharging over a weighed pail, and having glass windows inserted in the lowest part or "throat."

Fæcal matter and paper, from a "Rochdale Pail," filled by *actual use* at a mill, were used for charging the closets, 4 oz. to 6 oz. being employed in most cases, but 8 oz. and 12 oz. were used in a smaller number. In the Sanitary Institute experiments artificial material was used for this purpose.

The First Series of Trials (50 in number) were made with a *4-in. drain* (fall 1 in 40) and *4-in. disconnecting trap*. This trap was filled by *4 pints* of water and at the lowest part measured 3½ in. transversely and 4 in. vertically. Flushes of 3, 2½, 2 and 1½ gallons were employed, the result being that 3 gallons invariably sufficed to thoroughly flush closet, drain and 4-in. trap; a 2½-gallon flush generally failed to clear the 4-in. trap; with 2 gallons the interceptor was not once cleared, and most of the solids were left in the trap. By repeated 2-gallon flushes in rapid succession causing a head of water in the drain, the trap was eventually cleared with a rush, but this did not happen if one flush were allowed to trickle away before the next followed it. A 1½-gallon flush was found to be of

little use. The drain was never cleared and became rapidly blocked.

The Second Series included 21 experiments, and was made with a 6-in. drain (fall 1 in 60) and *6-in.* disconnecting trap, which, it is noteworthy, *required 12 pints of water to fill it*, and at its lowest part measured 5⅛ in. transversely and 5⅝ in. vertically. Flushes of 6, 4, 3½, 3 and 2½ gallons were used, and it is a remarkable fact that though 3 gallons and upwards sufficed to clear the closet and drain each time, the *6-in. trap was cleared by a 6-gallon flush in only 2 out of 4 cases;* 4 gallons cleared it in only 1 out of 6 cases, and anything less than 4 gallons altogether and repeatedly failed to clear the trap.

The Third Series numbered 22 experiments with a 6-in. drain and a 4-in. intercepting trap. With a *3-gallon* flush the closet, drain and trap were efficiently cleansed every time, but a flush of less than 3 gallons failed each time to clear the drain and to reach the trap.

The Fourth Series (18 trials) with a Unitas *wash-out* closet, 4-in. drain and 4-in. interceptor, flushes of 3, 2½, and two gallons were used; 3 gallons sufficed to clear the trap in 2 out of 6 cases. With smaller flushes, the *trap* retained a portion of the charge in every case; in 5 cases the drain was not cleared, whilst in 8 the closet trap was not cleared, due evidently to the inherent faults of the *wash-out* closet.

I shall be pleased to supply fuller details of these results to anyone interested in the matter, and I venture to submit the following

Conclusions.

1. *That 3 gallons is the minimum amount that can be relied upon for efficient flushing*, i.e., prompt carriage of dejecta through closet, drain and interceptor to sewer, even with a good form of *wash-down* closet, well laid 4-in. or 6-in. drain, and good 4-in. interceptor.

2. That if an *inferior type of closet* be used or *if the intercepting trap exceed 4 in. in diameter, 3 gallons is clearly not sufficient* for effective flushing. The proper remedy then, however, is to correct such structural deficiencies rather than to increase the flush.

3. That *if no intercepting trap be employed a flush of* 2½ *gallons* is the minimum amount that can be relied upon to efficiently cleanse the closet-trap and drain.

4. That *the invariable employment of a disconnecting trap* as recommended by the Model Bye-laws *is far from being an unmixed benefit*, and owing to the obstacle which the disconnecting trap presents to the cleansing of house drains, *its use should be strictly limited to those dwellings inside which a drain opening exists*,

e.g. in the cellar, and that if such drain-openings inside houses were prohibited in new dwellings disconnecting traps might, with great advantage, be entirely dispensed with.

There is much reason to believe that we have hitherto exaggerated the noxiousness of sewer air; assuming, however, that it is injurious in its effects, the object of a disconnecting trap is wholly gone if we keep all drain openings *outside* our dwellings, and having done this it is absurd to continue to insist on disconnecting traps which only diminish the efficiency of the water-flush.

Is Economy in Water effected by the use of Waste-Water-Closets?

In order to elucidate this question two blocks of exactly similar houses were recently selected in Stockport. At the request and expense of the Sanitary Committee the water supplied to each block between 7 a.m. on October 28th, 1896, and 7.30 a.m. on May 13th, 1897, was metered by the Water Co. with the following results:—

Lot *A*. 10 houses with waste-water-closets used 65,720 gallons, or 33·3 gallons per house per day.

Lot *B*. 14 houses with ordinary water-closets used 151,320 gallons, or 54·8 gallons per house per day, showing *a saving of exactly 21·5 gallons per house per day in slop-water houses.*

In a similar and more recent experiment in Manchester, the City Surveyor, Mr. de C. Meade, M.Inst.C.E., has curiously enough obtained an exactly identical result.

[illegible]

[illegible]

[illegible]

times. These methods, though not ideal, serve their purpose well enough, but the imperfections and difficulties in the processes for determination of the dissolved oxygen and carbonic acid have delayed the recognition of the importance of these determinations. It is in respect to these two substances that recent progress in the methods of water analysis has been most marked. The gasometric methods, though now very satisfactory, are too laborious, and have the disadvantage of giving only the total carbonic acid and not its various forms. Pettenkofer's well-known method for carbonic acid is open to the same objection, and is deficient in accuracy. The volumetric methods for dissolved oxygen, such as Schutzenberger's, require very complicated apparatus, and as usually carried out are affected by an error due to diffusion which renders the results nearly valueless. Recently, Thresh has proposed a method in which nitric oxide acts as an oxygen-carrier and liberates an equivalent of iodine, which can then be titrated. This method gives excellent results, but requires an atmosphere of hydrogen or coal gas, and is still somewhat complicated. The method which I strongly recommend is that of Ludwig Winkler (described by me in the *Chemical News* in 1894). In this method recently precipitated manganese hydrate acts as the carrier of oxygen, and the equivalent iodine is liberated and titrated as in Thresh's method. It is very accurate and of marvellous simplicity. No neutral atmosphere or special apparatus of any kind is necessary, and it can be carried out upon the spot if required.

Among the results obtained by the use of this method is the knowledge of the fact that water can be supersaturated with oxygen and remain so. This fact has been proved by the author and Gill independently by saturating the water at a low temperature and raising its temperature, when the water remains supersaturated. He has also proved that if saturated under pressure the water remains largely supersaturated upon removal of the pressure. He has found this condition of supersaturation not all all uncommon in surface waters. The oxygen available for bacteriolysis is not therefore limited to the solubility of the gas at the actual temperature of the water, and the degree of aëration must strictly be referred not to the temperature but to the ratio of oxygen to the dissolved nitrogen.

With regard to the carbonic acid, it has long been known that the fixed carbonates in water can be simply titrated with standard acids, and the use of methyl orange as an indicator has vastly simplified this process. Since Trillich, in 1890, showed that free carbonic acid could be accurately titrated by the use of standard sodium hydrate or carbonate with phe-

nolphthalein as indicator a great advance has been possible. It has hitherto been doubted or disputed that natural waters contain calcium carbonate dissolved as bicarbonate. The use of Trillich's method, however, showed that ground-waters constantly contain an excess of carbonic acid over that required to form bicarbonates, and that the total carbonic acid in such cases was divisible into three parts: the free portion which is acid to phenolphthalein, the fixed which is combined with the lime, the remainder which has no effect upon the indicator. By experiments upon artificial and natural water he showed, in 1894, that this remaining carbonic acid was equal to the fixed portion, and that the water therefore behaves analytically, exactly as though containing its lime and magnesia as bicarbonate. This assumption leads to correct results for the total carbonic acid, and this was also proved simultaneously in Germany by Kippenberger.

This result is a very strong argument for the existence of calcium bicarbonate, a question which the author is at present investigating further.

In the case of potable waters, therefore, the question of determining the carbonic acid in all its forms is now solved in a very simple and expeditious manner. It has been found of great value in characterizing a ground-water and showing the condition of surface waters, and also in investigating the action upon lead, iron, and zinc.

Recent experiments also enable him to state that he had tested the method upon waters deficient in carbonic acid, and therefore alkaline to phenolphthalein, such as sea and estuary waters, and found it gives accurate results. Dittmar, in the "Challenger," reports, strongly urges the search for such a method, which he predicts would have valuable results if systematically applied.

The author is at present engaged upon the applicability of the method to sewage and highly polluted effluents in which case he feared that the presence of ammonia and organic acids such as butyric acid would interfere. He has succeeded in completely eliminating the effect of the butyrates, but in strong sewage the ammonia has unfortunately proved to interfere seriously. In dilutions such as are necessary to study the process of bacteriolysis in polluted waters he has, however, obtained very good results; and in any case, combined with Dittmar's so-called "vacuum process," he has found a method which fully answers in a simple way the exigencies of the problem, both as to accuracy and simplicity. The details of these enquiries must be left for another occasion.

The President of the Section (Dr. Sims Woodhead) remarked that the paper was a very interesting one and of very considerable importance. While agreeing generally with what Mr. Seyler said, he wished to point out that he laid somewhat too slight stress upon the importance of bacteriological analysis. He was convinced that any information available should always be utilised, and he might say that bacteriological examination when properly conducted was capable of affording very considerable information as to the quality and varying condition of water. The mere enumeration of organisms could only in certain cases afford any satisfactory information, but the use of special methods were gradually coming into use and the character of the results obtained, and as compared with one another, definite standards often gave most important information. He might say that in examining water sent to him he now invariably used a method which had been devised in his laboratories by his friend, Dr. Cartwright Wood, for the purpose of determining the nature of organisms in water, by which they were enabled to make out, even in a very short time, whether a water had surface relations or not. The number, species, and action of organisms were undoubtedly of importance, but if it could be proved that water had surface relations, and in a comparatively short time, then the water at once became an object of suspicion, and its bacteriological and chemical conditions, along with careful inspection, were at once called upon to help them to determine the exact nature and cause of these surface relations. They had of course only to deal with the great problem of differentiation between pure water organisms which might be found in any water, and organisms which had been derived from surface or contaminated sources. He had taken a great interest in the paper and thought that the question of carbonic acid was one of the most important they could consider. There were many present who were well versed in these matters, and he hoped that those who felt competent to take part in the discussion would do so and put their remarks in as simple a form as possible in order that all might understand them.

Mr. W. J. Dibdin (London) remarked first of all as to colour of water; he might say that the ratio of colour to suspended matter varied very considerably with the time of year. If they took their samples after the rains had washed down the hills and valleys, their streams were the very pink of perfection; and they got a condition of things totally different to what they got later in the year, when the autumn leaves and other organic matter had entered the streams. He knew that a great deal had been done in regard to the examination of organisms, and during past years the bacteriologists had been very prominent, and he thought they had secured a very great advance in the bacteriological examinations. But whilst he heartily joined with the chairman and others in appreciating most fully the value of a proper bacteriological examination, he did not think that sufficient attention was paid to the microscopical examination of the matters in the water. He had taken samples of water and

had made his microscopical examination, and from the character of materials he had found he had formed an opinion, and then checked it by other means; and he had never been very far wrong. If he were bound to judge on one factor alone and give a hasty opinion, he would rather have a microscopical examination than any other. But there could be no question whatever, that, in forming an opinion, it was unsafe to take any one or two or three factors when they could have the whole. Another point he wished to speak upon was the knowledge of local conditions when an analysis had to be made. Upon this point Sir Edward Frankland had said that wherever it was possible, the analyst in important cases should himself take the sample of water. He (Mr. Dibdin) had always held that the collection of the sample was very often of more importance than the analysis. The opinion should be based upon the knowledge of the local surroundings, which knowledge was one of the greatest helps, specially in doubtful cases, and it was in doubtful cases where individuality came in. The estimation of the dissolved oxygen was a point which impressed him very strongly, because for twenty years he had carried out examinations on dissolved oxygen in various waters; and he was one of those who had been imprudent (?) enough to use Schutzenberger's methods. It was not until the year 1887 that it was shown that if they used Schutzenberger's method improperly, it would give wrong results, Of course it would, but he had used it properly. Then of the other methods, that of Thresh was a most admirable one, and one which he had used very largely indeed. But no doubt they found that if they used either of those processes with mixtures of waters, part sea and part fresh, with various proportions of manufacturers' refuse and sewage, such as that which goes down the River Thames, the different processes would give very discordant results. The results might agree at times and at others disagree, and he found there was only one method which gave him absolute confidence. It was best to take the samples of water into the laboratory as quickly as possible, and to pump out the gases and estimate them. That gave him the only systematic basis which was worth anything, and in his experiments he found that a simple form of pump was most convenient. A point he wished to make in conclusion was that there was a great danger in trusting absolutely to any process other than the gasometric, while they were dealing with water containing sewage matters. If they had clear water then any one of these processes might act very well.

Dr. Bushell Anningson (Cambridge) stated he wished to emphasise his own experience that the knowledge of the locality was a very important matter in getting the proper interpretation. There was a general practice, he believed amongst inspectors who collected samples, to carefully conceal the source. It was sometimes of very great value for instance to know what was the significance of the total solids that the analysis indicates; it might be a water with certain known qualities of total solids, and if the water became contaminated with sewage, which contained nitrates, the total solids would be

thereby increased, and afford a very valuable indication. If the analyst knew what naturally the water should contain, and he found something unusual by knowing the source of the water, he might give valuable information.

Dr. J. S. Tew (Tonbridge) said that what he wished to express an opinion upon was the relative value between chemical and bacteriological analysis. No doubt the most importance should be attached to the chemical, but that the bacteriological should be left out of the question was, he thought, far from right, and the knowledge obtained by a regular bacteriological examination was most useful. Information from all sources possible should be obtained for safeguarding water supplies. He was in the habit of regularly examining certain public water supplies both chemically and bacteriologically. One of these is derived from wells in the gravel not more than thirty feet deep. The water had given an excellent chemical and bacteriological analysis for many months past, but in the bacteriological examination made during August and September, the water showed a very marked increase in the number of organisms, rising from the average of from 30 to 90 to 2,000 and over. They did not attach the importance to the actual number as was the case a few years ago, but when constantly examining water, and finding there was such a rapid rise, it put them on their guard, and in this particular instance, on making an examination of the gathering area of the waterworks, he found there were cracks in the ground going down two or three feet, and there was no doubt that this surface relation with the water was the cause of the rise in number of the organisms. No bacteria of a noxious character could be detected by the usual methods. This was only a simple instance where he thought a bacteriological examination had put them on their guard where chemical analysis showed nothing, and enabled special precautions to be taken for ensuring the continued purity of the supply.

Dr. Ewart said he fully endorsed the remarks of the Chairman when he said that they could not afford to put any particular method of examination aside. He thought that one feature of the report to the Government with respect to the recent Maidstone epidemic was to show of what value it was that one should know the natural features and the position of the special water concerned. Mr. Adams, in his report of the analysis, had recourse to the natural position of the water and that led him, unfortunately too late, to be able to point out that the bacteriological examination gave an important negative result, that although the albuminoid ammonia had not increased, the nitrates had gone up. They could get a great deal more certain results by using all methods, but the one point he wished to bring out was the necessity there was for constant examination of water intended for domestic supply. Without that, and he included the chemical and bacteriological examinations, he thought they were liable to be faced with a great epidemic. He believed that it was quite clear from the report that if the water had

been more regularly examined, they might probably have been saved the great loss of life which was the result of the Maidstone epidemic. He thought that an examination once a month was far too seldom, and was of opinion that there ought to be something like the London system of the examination of water enforced by all local authorities. The real fact was, the examinations were not frequent enough nor systematic.

Mr. J. O. Littlewood (Mansfield) spoke of the cultivation of bacteria anaërobically in glucose formate broth, remarking that by that means they had a method of completely damping down all the ordinary bacteria except *b. coli* and *b. typhosus*, and as the latter were scarcely ever found in water, it was of real practical use in giving approximately the number of coli present.

Alderman Compston (Rawtenstall) remarked that some health committees thought it was better to have simply the results of the analysis from the analyst, because their medical officer, who knew the source, &c., of the water, was better able to form an opinion as to probabilities in connection with the ground than the analyst. So having the medical officer's personal knowledge of the locality, *plus* the results of the analyst's examination, the two together were considered by his own committee as furnishing more reliable guidance than if the analyst alone gave his opinion founded on his analysis, and some superficial knowledge provided by the sanitary inspector as to the ground. He quite endorsed the importance of having bacteriological as well as chemical analysis.

Mr. Dibdin (London) asked the last speaker what he would think if a patient called in a doctor, and after telling the doctor he was ill, and the doctor said, "Got a pain?" the patient answered, "Oh dear no, you have to tell me that." "Well, what is the matter with you?" asked the doctor, and the patient answered, "Oh you have to find that out, it is your business. I want you to cure me." That would be exactly the same line as an authority saying to the analyst, "There is a sample of water, tell us what is the matter with it?" and he personally distinctly declined to make an examination, and to give an opinion upon a sample of water unless he was trusted with the same confidence which a patient reposed in his doctor.

The President of the Section (Dr. Sims Woodhead) remarked that he thought Alderman Compston and Mr. Dibdin held almost identical views, but were looking at the matter from different standpoints. If an analyst were asked to analyse the water only, it was not necessary he should have the information; but if the analyst were expected to give an opinion, he must have access to all the information obtainable.

[*For further discussion on this paper see page* 663.]

"*Interpretation of Results of Water Analysis*," by SIDNEY BARWISE, M.D., D.P.H.

(FELLOW.)

I READ this short paper as a protest against the too frequent practice of some analysts of giving definite reports upon the suitability of samples of water for drinking, merely upon the results of a single chemical analysis; and I wish to suggest, that it would be a much better practice for analysts to submit the results of their analyses to be interpreted by some person who has a thorough knowledge of *the pedigree* of the water in question, derived from a careful inspection of its source. On this question the Local Government Board have, I am pleased to say, done excellent service, in always insisting upon and emphasizing the importance of inspecting the source of all waters. Indeed, not infrequently they employ a practical geologist to inspect the source of a water in company with a medical inspector, the results of the analysis of the water being interpreted in the light of the information obtained by the inspection of its source and the investigation of its history. The chemist is quite justified in reporting upon the suitability of a water for various manufacturing purposes, as this is a matter of chemistry alone depending upon the mineral constituents of the water, and my remarks exclusively refer to reporting upon the suitability of waters for dietetic purposes. The figures obtained on the analysis of water is a *question of fact:* the report is a matter of inference to be made not only from the results of the analysis, but from a large number of other considerations.

Sir George Buchanan, in the Annual Report to the Local Government Board for 1889 wrote: "Unless the chemist is acquainted with the origin, and liabilities, of the water he is examining he is not justified in speaking of it as 'safe or wholesome,' if it contain any trace whatever of organic matter, hardly indeed if it contain none. The chemist can in brief tell us of impurity and hazard, not of purity and safety—for information about these we must go with the aid of what the chemist has been able to tell us, in search of conditions surrounding the waters."

This inspection should be made in the case of public underground water supplies by a competent geologist, and in other cases should only be entrusted to one who has had actual experience in practical sanitation, as the inspection involves the use of judgment as to what may be considered a safe distance

from sources of pollution under different geological and structural conditions.

Unless a careful inspection of the source of a water is made, calamitous results may at any time follow, as in the Tees Valley outbreak of typhoid fever. In this instance several distinguished chemists pronounced a water to be pure and wholesome, which was found by the late Dr. Barry, of the Local Government Board, to be receiving crude sewage and the soakage from privy middens. Sir Edward Frankland reported the water to be "free from every trace of previous sewage contamination." Another well-known authority said his results negatived "any suspicion of contamination by sewage or cesspool drainage"; three or four other chemists gave the same opinion. Yet it was proved by an inspection of the gathering ground that sewage and the soakage from middens drained freely into this water.

After having the whole of the facts before him, it was of this water that Sir Richard Thorne Thorne subsequently wrote: "Seldom if ever has the proof of the relation of the use of water so befouled to wholesale occurrence of typhoid fever been more obvious or patent." Several similar occurrences have been recorded by the Medical Department of the Local Government Board.

As another instance bearing on this point I quote the following from Thresh, one of the highest authorities upon water questions:—"Within the last few weeks I have detected a cesspool within twenty yards of a collecting well of a public water company, the cesspool receiving the sewage from a group of cottages. I had a short time previously examined the water and found it satisfactory from both a chemical and bacteriological point of view. After the cesspool was discovered I took samples of the water. The water flowing in on the side nearest the cesspool contained more bacteria and more free ammonia than the water entering on the opposite side; neither contained any appreciable amount of organic matter."

Another point which has to be borne in mind is that there is no fixed distance which may be called a *safe* limit from sources of pollution; each case must be judged upon its merits. For with close sandy rock in which the subsoil water travels through the pores of the rock, purification by bacterial action and subsidence may be complete in a comparatively short distance; on the other hand, with a very pervious rock lying on a bed of clay, with flagstones, shales, mountain limestone, and other formations, the subsoil water travels in well-defined cracks and channels, and little or no purification can be effected.

The outbreak of typhoid fever at New Herrington (Durham)

was shown by the Inspector of the Local Government Board to be due to the pollution of subsoil water from a sewage farm three-quarters of a mile away. So also at Lausen, sewage matter after percolating through gravel for the distance of a mile caused an outbreak of typhoid fever by gaining access to a public water supply.

The important point to be ascertained is the direction of the flow of the subsoil water; this may be in the direction of the fall of the surface, it may be in the opposite direction to the fall of the surface. It may be in the direction of the dip of the strata. Below the level of the line of saturation, it may even be against the dip of the strata.

Having made a careful inspection of the source of the water we shall be in a position to decide whether the results of the analysis are consistent with what should be expected from such a source, and to do this we must have *normal standards of purity worked out locally.* For this purpose it will be necessary to collect samples of obviously unpolluted waters with which to compare the water upon which we have to express an opinion.

When the local normal chlorine, the normal nitrates, and the normal solid matter are known, any serious departure from them may justify the chemist in concluding there is pollution. But this is entirely a different matter to drawing conclusions from the isolated fact of a single analysis.

Every village will have its own local standards, and even several sets of these where the geological formations are much broken up. It therefore appears to me that the specially trained local Medical Officer of Health is the only person in a position to bring the necessary information to bear upon the question, to accurately interpret the meaning of the facts revealed by the chemist in his analysis; and I submit that where a specially trained medical officer is appointed, it is better that the chemist should submit the results of his analysis to him, and leave them to be interpreted in the light of local standards and the source, surroundings, &c., of the water.

[*This discussion applies to papers by* Mr. SEYLER *and* Dr. S. BARWISE.]

Dr. S. RIDEAL (London) stated that it always seemed to him that it was very difficult to form an opinion based upon an isolated standard, and that really the thing they wanted to aim at was to get hold of some definite ratio which would enable them to ascertain whether the water was polluted or not. If they could determine upon a ratio of "oxidized nitrogen" to "unoxidized nitrogen" they

had something definite to go on. Similarly, there must be a ratio between the number of ordinary water organisms to "sewage organisms" which might be fixed as a safe limit for any particular river or process.

Mr. A. F. Burford said that it did not matter whether the analyst were a consulting chemist or a Medical Officer of Health if he were capable of doing his work. With regard to local standards, standards given them would be very local, but there was very little help for a man who wanted local standards. Take practically any county. They would want three or four standards with regard to each side of the county. They got one side wooded, say, and the other side of marl, and one side out of accord with the other. He thought they wanted all the information they could get on the subject with regard to locality, and that the ratio of one class of water was utterly inappropriate to another, and a different set of factors altogether would necessarily be needed. There was no hard and fast line, and the subject was a very wide one, but he wished they had more district averages, and more detailed information was wanted, and they also wanted a water map of the country.

Mr. John White (Public Analyst for Derbyshire) remarked that he should like to say as a public analyst that he welcomed all information that could be supplied as to the origin and source of samples of water submitted to him for analysis. In Derbyshire they had forms which were filled up and sent to him with all samples of water which he analysed, correctly describing the position, age, depth, and surroundings of the well. He fancied the Medical Officers of Health very often forgot that the large majority of the samples submitted to the Analyst were so largely polluted that the Analyst was fully justified in condemning them, even if he did not have particulars of the source and surroundings of the water. He should object to samples being submitted to him for analysis upon which another individual was to give an opinion. It seemed to him that the analyst was the best person to make the report. Provided that he was supplied with information as to surroundings and sources of the water he was the best person to diagnose. Surely the physician who diagnosed the disease was the best man to prescribe for it. He would mention that the chemist had over and over again been able to point to pollution in cases where the bacteriologist had found nothing. He should not have quoted it now but for the fact that some gentlemen who had spoken had tried to show the importance of bacteriological examination as compared with that of chemical analysis. The observations that Dr. Anningson made as showing the advantage of knowing something of the source of the water, were not, he thought, particularly to the point. He took it that almost every analyst who examined water knew, that if he found water containing a considerable amount of iron together with a large amount of free ammonia, the latter would be of mineral origin, and

could not be considered to indicate pollution. Knowledge of the source of the water would not be necessary to the capable analyst to enable him to arrive at the correct interpretation of such a problem as this.

Dr. Ewart thought that the results obtained should be submitted to the Medical Officers of Health who knew the whole of the existing circumstances, and by that means they got the full value of the special technical work of the analyst and of the Medical Officer.

Professor Notter (Netley) remarked that the question was a wide one, which concerned public health. The fact was they had to take the medium course in most of these things and feel their way before coming to any decision. It was true that water analysis without interpretation of results could be made by any chemist, but in order to draw correct inferences from any analysis the additional information as to prevalent disease, etc., was of the greatest importance. It had struck him whether it would not be better, instead of testing the water from the tap end of a supply, to look at the question from a large and broad view, and safeguard our supply by systematic examination of gathering grounds at the source, as well as by analysis. In fact, by securing an adequate pure supply by constant careful watching of gathering grounds and sources, he thought there would be little fear that people would suffer from water poisoning. He did not, however, mean to say that chemical and bacteriological analysis taken alone would not afford useful information; it was right to make them, but he thought that analysis was only good for the day, the hour, the time, and the season, and when made only once a month was but of little security for the community. He would like to impress the fact that for anyone who had to draw inferences from results no information was superfluous.

Dr. Charles Porter (Stockport) remarked that until he had the pleasure of studying the Maidstone report he was inclined to look upon the bacteriological and certainly the chemical examinations as practically of almost little moment if one were satisfied with the pedigree of a water. Dr. M. A. Adams had, however, emphasized the importance and great value of instituting "a local chemical standard" for water supplies; and similar suggestions had been made by Prof. Delépine, and more recently by Prof. MacWeeney, in regard to bacterial examinations. Such standards would undoubtedly invest the results of our present methods with a significance and value hitherto imperfectly appreciated. He noticed also that in connection with the Maidstone enquiry, the President of the Section had employed inoculations of broth-cultures of the water-organisms, the results being regarded as an index of the liability of such water to surface relations. This method he believed had not before been employed in this country, but in another recent enquiry of which he had personal knowledge it had, in Dr. Woodhead's hands, yielded significant and suggestive results.

Dr. MacWeeney (Dublin) remarked that in his opinion chemical analysis needed no vindication, and that the development of bacteriology had in no way detracted from its value. It might be well for those who undertook analytical work to familiarise themselves with both methods. There was one point upon which he wished to lay stress, and that was that the examination should be biological rather than bacteriological; it ought to be directed, not merely to the enumeration of bacterial colonies, but also to the algæ, fungi, and protozoa present in the sample. The several species of these organisms had perfectly defined laws of *habitat* and distribution, and the presence of certain species was indicative of certain forms of sewage and other pollution. By the careful study of the fauna and flora of waters of known degrees and kinds of pollution a relation could, in his opinion, be established between the nature and amount of pollution on the one hand, and the species present on the other: so that where one of these factors was known, the other might be inferred with considerable accuracy. The totality of the fauna and flora, moreover, was the expression of the *average* condition of a water, and therefore of much greater value from a hygienic standpoint than the number of bacterial colonies, which, as is well known, undergoes great variation in a few hours without involving any corresponding alteration in the hygienic value of the water. For these reasons he submitted that the biological (as distinguished from the bacteriological) examination of variously polluted waters is attracting more attention than has hitherto been paid to it, and can in the hands of analysts who are possessed of the necessary biological experience and acumen be made to yield results of great practical value.

Professor Notter wished to draw the attention of those persons interested in the subject of the taking of water analysis and the bacteriological examination, to the water-bottles used by the British Institute of Preventive Medicine.

Mr. George Hanbury (Gloucester) said that his chief object in rising was to enter a protest against something said by Mr. Seyler in the early part of his paper. He seemed to intimate that it was desirable that simple methods should be devised by which people who had a little experience could make periodical representations. He could assure him that if he periodically examined the river Severn he would find his efforts absolutely useless. The colours depended greatly upon the rainfall, and any treatment upon the colour of the water was absolutely worthless, and he thought it would be a dangerous thing if they entrusted anyone to make examinations in the slip-shod manner of years ago. It seemed to him the proper method was to give the analyst every information, let him make his analysis, then submit that analysis with remarks to the Medical Officer, and he might then get his information. If there were any discrepancy let the analyst and the Medical Officer come together and discuss it.

Dr. S. G. Moore (Liverpool) said he would like to express his views on the subject, which was of very wide interest and extremely great importance. He would point out that there were very many different classes of individuals concerned in the problem, and it did not seem to him that there was any antagonism between any of these gentlemen. He thought that having one object before their mind, they would find no difficulty in working together; but it was manifest that one of them must report, in order that the analysis might be submitted to the authority in such a form that would enable the latter to act upon it. It did seem to him that the sanitary inspector would have one point of view, the bacteriologist, the biologist, and the chemist, each another; but when it came to bringing the different reports in correlation, the Medical Officer of Health, being a medical man, and having special experience as a Medical Officer of Health, was the only individual who could reasonably claim to give intelligently the result. Moreover, he is the official adviser in Public Health to the sanitary authority.

Mr. Littlewood (Mansfield) remarked that for the satisfactory interpretation of results, he thought that it would be an advantage if analysts were to state the methods used particularly with reference to the estimation of nitrates. He had tried four different methods with four different results.

Mr. C. Seyler (Swansea) briefly replied that with regard to Mr. Dibdin's statement about colour and oxygen, of course he knew that if there was a large amount of matter in suspension it would affect the colour and in that case the water should be filtered. It seemed to him that the examination of the colour would in a few moments give an idea of organic matter present. Many points of interest had been raised, but he should just like to say with regard to interpretation of the chemists' results by anybody else he thought that would be impossible. Analysts used the permanganate process at various temperatures, some in alkaline, and others in acid solutions, and he thought that nobody could interpret the results except the analyst himself. He had his own standards and no one else could interpret them. He had, Mr. Seyler added, suffered very much from the refusal of public bodies to provide proper data for interpreting results, on the mistaken idea that they would be prejudicing his judgment, and this fact had led him to the study of the methods of estimation of carbonic acid and oxygen as a means of distinguishing surface from ground waters.

Dr. S. Barwise (Derby) in his reply said he was pleased to see the meeting was agreed upon one point—that there should be careful examinations of the sources of all waters. It is the duty of the Medical Officer of Health to inspect the sources of all public water supplies. If it were necessary for a district council to go before a bench of magistrates and ask them to close a certain well, they *would have to prove the* water was injurious to health. But, he

and, it was only a medical man who could sa
injurious to health. A satisfactory procedure w
make the analysis and the result of that analysi
the local Medical Officer of Health—a man who
the local circumstances of the source of the w
condition and nature of the subsoil yielding the
dition of the drains in the vicinity of its sou
bearing upon the question was the prevalence
fever, &c., in those consuming a water, and it w
officer of health who had reported such cases
which polluted water might give rise to.
direction of the flow of the subsoil water and t
of local standards. Now who could make loca
local man? He maintained that local stan
mapped out by some one with a very intimate
he thought himself that the only man to do it w
of Health of the district. He admitted that at t
were Medical Officers of Health who were not a
number was rapidly diminishing. Medical Off
had been specially trained were quite compete
The only person who could correctly interpret th
and say whether a water was or was not injuriou
Medical Officer of Health of a district, who kn
disease in the district, who knew the directio
subsoil water, the sources of pollution of the
standards of chlorine, nitrates, free ammonia, an

"Some Toxicological Aspects of M

SAMUEL WALKDEN,

(MEMBER).

THE following report of poisonous effects
engaged in chaffing mouldy hay is not clair
isolated experience, but within my memor
public intimation has been previously given
pation as attended with danger to health.

In March, 1889, five workmen and myself
up about 2½ tons of clover hay from a mou
to having it steamed in a Barford and Pe
paratus. Before starting, the men were w
kerchiefs over their mouths, and to breathe
nostrils. The engine and cutter ran from
Considerable volumes of white mildew dust
operation, penetrating the whole building,
(48' 0" × 24' 0" × 11' 0") and amply ventila

ırs after ceasing work three of the men and myself were ed with extreme chilliness and great prostration, combined 1 severe pains in the head, neck, back, and legs. There also giddiness and disinclination to eat or sleep, followed semi-unconsciousness. In all cases recourse was at once to repeated doses of whiskey, and in twelve hours from the dence of the attack recovery set in; at the termination of nty-four hours convalescence was complete. The two men felt no ill results that day, immediately on leaving work c strong aperient medicine, but on the second day similar is of ailing were apparent, though the invasion was milder, continuation shorter. No after evils were evident. In clusion, I think it only fair to mention that influenza had viously occurred in the district to a small extent, and ie may argue that the above subjective symptoms simulate ie of those which have occasionally been prominent in the ial stages of that disease. Whether there may exist any emblance between the organisms associated with mildew, and se companionable with influenza, I am unprepared to say, that these six cases referred to arose solely from mildew sons I think is indicated by the fact that other workmen on same premises not connected with the mildew dust remained fectly unharmed.

From observations extending over several years, no alterna- e has presented itself to me but to conclude that several at st of the microscopic fungi are capable of specific action as ırotic poisons; this opinion is further corroborated in a r instances by the experiences of other writers. "Dreadful cts are said to be produced by a species of black rust which icks the large South Europe reed Arundo donacœ. This is in probability the same species with that which attacks Arundo agmitis in this country, the spores of which produce violent daches and other disorders amongst the labourers who cut reed for thatching." * A somewhat analogous instance h regard to the action of the spores of larger fungi are also orted by the same authority.† With respect to the opera- ı of the fungus Claviceps purpurea (ergot of rye) "small es of the aqueous extract injected beneath the skin of mals caused a loss of sensation, and of the power of co-ordi- ion." ‡ Without wishing to trespass too widely beyond the pe of this paper, I should like to refer to the pathogenic ulds to which fish and flies are seriously subject; also to

"Fungi: their influence and uses," by M. C. Cooke, M.A., LL.D., edited Berkley, 1883, p. 217.

Ibid, p. 216.

(Med. Record), Jan. 7th, 1873.

examples of parasitic moulds, "Lichtheim's Mucor Rhizopodiformis, which will not develop on the dog but grows vigorously on the rabbit. Aspergillus attacks both of these animals."* "The air of a ward in which cases of erysipelas repeatedly occurred was found loaded with fungi."† "Without attempting to associate the cattle plague in any way with fungi on grass, it is nevertheless a most remarkable coincidence that the year in which the cattle disease was most prevalent in this country was one in which there was, at least in some districts, more red rust on grasses than we ever remember to have seen before or since."‡

Speaking from personal experience, I have rarely observed an animal to remain in good condition when either fed on mouldy food or living in the close proximity with mildew; and upon the advent of fungi appearing either upon the walls or floors of buildings—if allowed to remain it has often been succeeded by disease—remove immediately all trace of fungi, allow the normal conditions to remain the same and disease is usually warded off. You may have results arising from cold or heat and wet, but these alone do not appear to have specific malignant effect in inducing the accession of bacteriologi disease unless it supervenes adventitiously. In the attempt the elucidation of determinate factors, and in correctly estim ting the assignation and value of results of individual effect, enquirer is confronted by so numerous surroundings contem raneously tending either to react, accentuate, or conflict influence of each, that the isolation of specific action of milde and moulds other than that of neurotic poison appears unc firmed. At the same time, notwithstanding this, it may not an unreasonable possibility that specific forms of fungi m influence the association and succession of specific forms pathogenic bacteria. As a demolishing agent and preventat of fungi, turpentine gives good results, and has an advanta over carbolic acid of being non-poisonous, does not destr colour, or perish the article to which it is applied. For bric work and pavements where copious use of fluid is admissil carbolic solutions are materially cheaper.

The President of the Section (Dr. Sims Woodhead) remark that they had two explanations of the case. It appeared that the one hand it might be due to the action of fungus, which h

* "Comparative Morphology and Biology of Fungi." Dr. Barry, p. 359.
† "Hygiene," Dr. Parkes, p. 112.
‡ "Fungi: their influence and uses," by M. C. Cooke, M.A., LL.D., edit by Berkley, 1883, p. 217.

isonous properties, and on the other hand they had the fact that ıumber of men were occupied on work in a district where influza was somewhat prevalent. Then there was the fact that the en were all working in one place, and were from time to time in se contact with one another. Of course, as regarded mildew d fungi, they knew they were evidences of damp, and that they d a very deleterious effect upon the health of man.

Some Observations on the Natural Purification of Sewage," *by* HENRY KENWOOD, M.B., D.P.H., F.C.S., Assistant-Prof. of Public Health, University College, London, and WILLIAM BUTLER, M.B., D.P.H.

E experiments upon which this paper is based were permed by the authors during the six months ending July 24th. ıring this period 368 analyses were made, and it is thought ıt, although the results are not commensurate with the great ount of labour and time devoted to them, a few observations sing out of our work may be of interest to the Congress.

Our first business was to decide what installation to make for purpose of our experiments. After visiting the different ces, where measures had been adopted to effect the puri-ıtion of sewage through natural agencies alone, and after efully considering what appeared to us to be the advantages 1 defects of different methods, we decided upon the following talment, which was at once carried out on an experimental ıle on the Finchley Sewage Farm, and reproduced on a small del scale in the Public Health Laboratory at University llege. This model was found very useful and convenient for perimental purposes. For long periods it was treated simi-ly to the installation at Finchley, fresh sewage being sent in m Finchley to the laboratory in five-gallon jars.

We decided that the crude sewage should be admitted at the ttom of one filter bed, and after upward filtration under aërobic conditions, should be subsequently treated by inter-ttent downward filtration under aërobic conditions in one or re other beds.

No. 1 filter bed (24 ft. by 24 ft.) was accordingly filled as lows:—Two feet of coarse honeycombing were first placed at bottom; this consisted of old or broken drain pipes, and ıs, jars and other large objects picked from the dust heaps on farm. Above this layer 1 ft. of coarse clinker was placed l on the top about 1 ft. of finely sifted burnt ballast. The age which slowly came in at the bottom of the filter was nitted through a valve and was allowed to fill the filter bed, l ever afterwards to stand to a depth of 3 in. on the

[illegible]

in this method, and unlike that of Mr. Dibdin's coarse filter, requires no attention.

As detailed tables of analyses would extend the paper beyond the scope contemplated and would serve no useful purpose, it has been deemed sufficient for purposes of illustration to give the mean of a series of analyses where the sewage was traced through each of our three model filters. In speaking of the work done by the filters, however, the figures used are a mean of a much more extended series of analyses than are embodied in the table. In this way it is hoped that more reliable data on which to base our argument have been secured, although the table will be found to conform closely to what we have observed over a much more extended series of experiments.

The mean composition of the sewage of the Finchley District during the period in question has been :—

	Parts per 100,000.
Free and Saline Ammonia	8·1
Organic Ammonia	1·1
Organic N. (Kjeldahl)	2·0
Chlorine	12·5
Oxygen absorbed in 2 hours at 80° F. ...	8·1
Total solids	147
Volatile	79
Non volatile	68

*Table showing the Mean of Twenty Analyses in which the Sewage was traced through each of the three consecutive Model Filters.**

Crude Sewage.	Pts. per 100,000.
Free Ammonia	9·24
Organic Ammonia	1·67
Oxygen absorbed in 2 hrs. (Tidy's process.)	10·80
Total Solids	168
Volatile Solids	93

(1) Effluent from No. 1 Filter. After resting in Filter for 1 hour.	Pts. per 100,000.
Free Ammonia	7·95
Organic Ammonia	0·97
Oxygen absorbed in 2 hrs.	4·16
Total Solids	140
Volatile Solids	72

(2) Effluent from No. 2 Filter. After resting in Filter for 1 hour.	Pts. per 100,000.
Free Ammonia	2·91
Organic Ammonia	0·52
Oxygen absorbed in 2 hrs.	2·92
Total Solids	135
Volatile Solids	63

(3) Effluent from No. 3 Filter. After resting in Filter for 1 hour.	Pts. per 100,000.
Free Ammonia	1·21
Organic Ammonia	0·35
Oxygen absorbed in 2 hrs.	0·67
Total Solids	125
Volatile Solids	50

* It will be noted in these particular experiments that although the final effluent showed a high percentage purification it did not conform to a high standard of purity, but the purification was effected, from start to finish, in a *period of only three hours.*

Effluent from No. 1 Filt

After resting in Filter for 24 hours.	P 1
Free Ammonia	
Organic Ammonia	
Oxygen absorbed in 2 hrs.......	
Total Solids	
Volatile Solids	

The mean amount of organic nitrogen, a and saline ammonia in the sewage experim 8·6 parts per 100,000, and a mean of less t this figures in our final effluents. Of the ni for in the effluent, we believe that a large as ammonia, and doubtless some was retaine

Action of Anaërobic Fi

The sewage slowly passed into No. 1 reached the surface it was fairly clear and from suspended matter and its physical were very similar to those of the effluent fr although we were dealing with a much stro

The longer the sewage remained in the t the reduction in the opacity, but even at filtration the suspended matter is very gr about the same in fact as that in the sam sedimented for twenty-four hours, and no p finest find their way through the filtering most rapid filtration which has been atten very large amount of suspended matter w filter, when it was emptied and examined experiments very little, and that only in division, had been washed back; this on consist of only 43 per cent. of volatile soli with the slight evidence which the filtering of retained matter.

A microscopical examination of this retai the presence of an abundant fine granul rich in iron, particles of silica and carbon, a with chlorophyll and others without), a few l mainly), vegetable hairs, bundles of veg numbers of vegetable spiral vessels, zooglœ few striated muscle fibres, cotton fibres, and

We found that if sewage is passed str filter the oxygen absorbed in two hours, as method, is reduced about 30 per cent.; if t to rest in it for one hour the reduction exce

The oxygen absorbed, i.e. the oxidisab

however, apt to increase during the first twenty-four hours on the one hour figure in No. 1 filter, and then it diminishes, this increase amounts to a mean of about 20 per cent. on the one hour figure. The oxygen absorbed also goes up after the first hour the longer (up to four or five hours) the effluent remains in Nos. 2 and 3 filters.

It must not be supposed that the reduction is a mere holding back of the putrescible or oxidisable organic matter. The oxidisable organic matter, as estimated by Tidy's method, appears to be that of a transitional phase of the organic matter in its passage from that of a more stable organic compound to that of an ultimate product such as ammonia or carbon dioxide; it is probably represented both in the free and in the albuminoid ammonia figures, for, in old sewage the free ammonia is markedly reduced by filtration through filter paper. We found that filtration through filter paper caused a mean percentage reduction of about 40 per cent. in the albuminoid ammonia and 5-10 per cent. of the free ammonia in sewage twenty-four hours old. That free ammonia which is filtered off doubtless represents putrescible matter in its last stage of reduction to NH_3 CO_2 and H_2O. What goes on in our No. 1 filter-bed is a continuous reduction of the more stable organic matter to unstable organic compounds, and of these unstable compounds to the ultimate products of anaërobic organic decomposition.

Thus during the first hour of rest in a filter the oxidisable organic matter, as shown by a two hours estimation, is invariably reduced. If now the sewage be allowed a further period of rest in the filter up to, say twenty-four hours, this oxidisable organic matter is increased—especially in No. 1 filter. If a still further period of rest be allowed, say up to several days, a progressive diminution is to be noted. It appears that during the first hour the unstable putrescible matter is reduced to an ultimate stable condition in a ratio greater than that of the reduction of the more stable organic compounds to the intermediate unstable condition. Subsequently up to the twenty-four hours period the reverse holds true, and then, as the stock of more stable compounds is exhausted, reduction to the ultimate stable condition alone goes on, with a progressive diminution of the oxidisable organic matter.

The behaviour of the ammonias accords with what one might expect from the action of the filter on the oxidisable organic matter. The albuminoid ammonia shows a constant reduction during the first 24 hours in No. 1 filter. For the first hour our figures show a mean per centage reduction of 37 on the original sewage: at the end of 24 hours there is a further mean reduction of 20 *per cent.* (total 57 per cent.) on the albuminoid

ammonia of the sewage. After the
albuminoid ammonia figure appears to rise
tendency being downwards.

It will be noted that while the albun
oxidisable organic matter figures are both
first hour of resting in No. 1 tank, at the
has been in the case of the albuminoid am
duction on the 1 hour figure, whereas in t
absorbed figure there has been a marked i
figure. These facts are difficult to accour
for an explanation one must bear in mind
viz., that the albuminoid ammonia figur
nearly the whole of the nitrogenous orga
the oxygen absorbed figure includes not on
matter, but also carbonaceous.

The reduction of the albuminoid ammo
expect (in a filter where no nitrification c
in the free ammonia. That this increase
doubt, and many of the analyses indicate i
they frequently show a reduction of the
effluent below that of the sewage, and th
effluent has remained a few hours or a f
Sometimes it is reduced, sometimes increa
ing material was new, it was diminished to
than after large quantities of sewage had pa
The filter, in fact, would seem to have the
monia from the sewage and to store it in
later this storing capacity comes to an end,
a constant excess of the free ammonia of
of the affluent provided, of course, that wh
ammonia to its full capacity there was still
of free ammonia from the nitrogenous mat

Not infrequently, there was a reductio
the effluent, notwithstanding the fact th
become oxidised; and as at the same
ammonia had been reduced, one had to f
what became of the free ammonia, which
that it was being produced in the filter,
the effluent.

In order to discover whether free ammo
the filter, 50 c.c. of ammonia free distille
a shallow glass vessel with a diameter
this was placed on the surface of the
then inverted over it, so that the atmo
could take up ammonia only from th
up by the filter from a calculated free

amounting to 1·5 square inches. At the end of a certain number of hours the distilled water was Nesslerized, and the ammonia taken up was estimated. An average of a series of experiments of this kind gave ammonia absorbed equal to 0·5 mgm. for every square foot of filter surface per hour. The figure is given not as a definite measure of the ammonia given off, but as showing that it is very considerable, and will account in a large measure for the diminution of the free ammonia in the effluent under conditions where otherwise it seemed inexplicable.

In order to see whether this elimination of ammonia would reduce the ammonia in the effluent, the reservoir at the top of No. 1 filter was filled by upward filtration and allowed to stand for some eight days. A sample of the liquid was then taken and compared with some which was removed at the same time from the body of the filter. The free ammonia of that from the body of the filter was 19·5, whereas that from the top of the filter was only 7·25, showing, in the absence of nitrates, a reduction of ammonia by evaporation of 62 per cent. on a very high ammonia figure. It may be mentioned also that the oxidisable organic matter, as shown by the oxygen absorbed in two hours was also reduced from 4·88 to 2·88.

The functions of No. 1 filter may, therefore, be summarised as—

1. A straining off of suspended matter;
2. Dealing with this suspended matter so as not to allow it to accumulate unduly in the filter;
3. Partially purifying the sewage.

The analytical figures of the effluents were as low at the end of the experiments as at the commencement, and therefore the efficiency of the filter was unimpaired.

The Value of Secondary Filters.

It must be remembered in speaking of the work of a filter that it is not always manifest in the terms of a chemical analysis. Changes which can only be expressed in terms of stability and resistance are repeatedly made manifest. Thus, to take an illustration, the albuminoid ammonia figure of the effluent of No. 2 filter on June 23rd was 0·40. After an hour's rest in No. 3 it was reduced to 0·16, or 60 per cent. No. 2 in this instance had been charged with the effluent from No. 1 after the sewage had rested twenty-four hours in the anaërobic filter. Neither the twenty-four hours' rest in No. 1 nor the hour's rest in No. 2 had effected a satisfactory reduction in the albuminoid ammonia but their combined action had doubtless so shaken the stability of the organic matter which was

in terms of albuminoid ammonia that in its passage through No. 1 filter it was reduced by 60 per cent. The example is one of many that were noted, and is taken as first to hand to illustrate the importance of multiple filters for completion of a purifying process, the initial stages of which may not be discerned in the ordinary form of an analysis. We satisfied ourselves by many experiments that by the use of secondary filters a much greater degree of purification can be obtained in a shorter time than by means of single filters.

A filter like a living organism not only ingests but excretes, and we have found it a useful working hypothesis to look upon each filter as possessing a state of equilibrium which affects its powers of absorption and excretion.

The important point about this equilibrium of a filter worked regularly is that it tends to adjust itself to an average of the pollution of the affluent; thus the equilibrium of No. 1 differs from that of No. 2, and that of No. 2 from that of No. 3, the affluent of each, of course, having a pollution figure higher or lower than that of the other. It is for this reason that the necessity for multiple filters appears so great where strong sewages have to be dealt with. A filter will effect only a given percentage reduction on the pollution of its affluent when it has reached its maximum biological efficiency. If the pollution is high and if we represent the purification which can be effected by the filter as 50 per cent., the effluent will still be a filter liquid, and another 50 per cent. of reduction in another filter will leave 25 per cent. of the original pollution still to be removed, &c.

The fact that the effluent which is first drawn off from an aerobic filter is relatively so much worse than that which comes away at a later stage, and that the filter may suddenly and unaccountably become overcharged are further arguments for always making arrangements for passing the effluent through more than one aerobic filter.

If a filter has passed the equilibrium pollution figure should have been reached by excretion, and therefore its capacity for absorption should be greater, and the percentage reduction of pollution in the effluent should exceed the mean. On the other hand, if the affluent pollution exceeds the mean two results occur — 1st, to attain to its habitual equilibrium the filter must absorb less per cent. of the affluent pollution, and thus give a smaller percentage reduction; 2nd, its state of equilibrium being determined by this as by other affluents, the equilibrium pollution figure is raised. These facts are supported by a study of the figures of our experiments.

The facts which we ascertained with reference to ammonia

elimination into the atmosphere appear to show first that where no material nitrification goes on in a filter the nitrogen equilibrium is established by elimination of free ammonia. It was while the filters were rested that the most striking differences were observed. The nitrifying filter gave off no free ammonia at rest, the non-nitrifying filter, on the other hand gave off during the first 24 hours of rest ammonia = a mean of 0·39 milligram per square foot per hour. During the next 24 hours the ammonia eliminated was 1·8 milligram per square foot per hour, the mean for the succeeding 48 hours being only 0·06. The most active period of elimination is probably coincident with that of the most active reduction of the stored albuminoid ammonia to the free state, and the later stage of very low elimination with the attainment of the condition of nitrogen equilibrium. If this be so we have a convenient MEANS OF DISCOVERING THE PERIOD OF REST REQUIRED BY A FILTER WHICH HAS BEEN OVERTAXED. It is only necessary to make daily estimations of the ammonia eliminated, and when the active elimination has ceased we should know that the filter had attained its equilibrium, and was again ready for work.

The same tendency to equilibrium has been noted in the estimation of the total and volatile solids, and to favour this equilibrium solids may be sometimes taken up from the filter and at others deposited in it; that something more than a mere straining of suspended mineral matter occurs, and that often an actual precipitation of dissolved solids takes place has been shown by the fact that often the reduction of non-volatile solids by rest in a comparatively coarse filter has been far in excess of anything we have been able to effect by filtering through a double thickness of fine filtering paper.

It has been repeatedly observed that the first rush of filtrate after opening the exit valve of a filter is associated with the escape of a large amount of suspended matter, some of which is of an organic character. Before the coke breeze was placed in the model at University College it was very carefully washed in small quantities, yet when we removed it, it was found to be charged, even in No. 3 filter, with large quantities of fine particles of organic matter. This fact is suggestive and points to the conclusion that however the filter may be constructed as to material and size of the filtering medium, organic matter tends to collect in the filter, and is liable to be washed out from its lower zones when the rate of outflow is rapid. We found that by constructing our filters with a stratum of sharp sand at the bottom we were able to obviate this difficulty.

Our lowest albuminoid ammonia figures were got with the

[illegible] rest in our secondary filters. The point always to be borne in mind is that which has to take place is not merely the reduction of unstable matter to the ultimate stable condition, but the reduction of the more stable organic matter to the unstable. The reduction of the unstable to the stable or ultimate appears to be best effected by change of filters, that of stable to unstable by rest in a filter. High albuminoid ammonia, then, is an index for rest in a filter, high oxygen absorbed an index for passing to another filter under conditions permitting of good [illegible].

Gas Absorption by Sewage.

A stoppered flask, containing about 200 c.c. of sewage, was placed under anaerobic conditions by replacing its superincumbent atmospheric air with hydrogen gas. Anticipating from what we had observed in our No. 1 tank and from what is known to occur in Cameron's tank, a large evolution of gas from the sewage, provision was made for the escape of such gases. The flask was hermetically sealed by an india-rubber stopper, perforated so as to admit a piece of glass tubing, which, opening at one end into the superincumbent gas in the flask, was sealed at the other by dipping into a cylinder of mercury. On examining the flask next day, the mercury had risen in the tube, and stood more than an inch above that in the cylinder.

This could not be accounted for by any change in the atmospheric temperature and pressure, and was manifestly due to diminished pressure in the flask from absorption of the hydrogen gas. Flasks containing atmospheric air, coal gas, nitrogen, were placed under similar conditions, with the invariable result that the mercury rose in the tube, until in some cases it was [illegible] into the flasks. These gases are used by the micro-organisms in their life processes, and doubtless we have here one of nature's provisions for maintaining the earth's supply of fixed nitrogen, although perhaps not so active a process as that suggested by Sir William Crookes for the [illegible] of the wheat consumers of the twentieth century. The absorption was most rapid in respect of atmospheric air, and fresh sewage seemed greedy for air; and if it could not get atmospheric air, it took whatever came to hand.

After some weeks the mercury sinks in the tube, with the formation of black sulphide on the surface exposed to the [illegible] atmosphere; but never in the flasks kept in the light, even [illegible] a period of many weeks, does it sink to its original level. [illegible] absorption was found to go on in fresh sewage in the dark [illegible] in the light, but more slowly in the dark. It was observed [illegible] occur in sewage kept at rest and in sewage kept in motion [illegible]

slow continuous flow through a flask where a limited quantity of air or gas was exposed to it. Under such conditions it was found to absorb every particle of the available gas imprisoned in the flask, and that in the case of fresh sewage in a very short time. As the sewage got older less gas was absorbed, and there came a time, in the case of sewage kept in the dark, when gas was given off in considerable quantities. A quantity of this gas was allowed to collect in a flask, through which the sewage slowly flowed, and this gas was exposed to the action of fresh sewage, which very quickly absorbed it. Light, temperature, and the age and amount of sludge in the sewage appeared to be the determining factors of gas production and absorption. To what extent each of these factors played a part was not determined, but it may safely be said that light and freshness seemed to favour gas absorption ; darkness and age, gas production.

The Septic Tank.

Sewage kept out of contact with atmospheric air in the dark and at rest so as to deposit its sludge—these are the conditions under which the microbes work in the septic tank, and by reproducing these conditions on a small scale one is able to make sure that the same sewage is being dealt with. In comparing sewage kept under such conditions in bulk, as in the septic tank with sewage kept in the dark under similar conditions in a filter constantly sewage-logged, our investigations point decidedly in favour of the filter. As stated, the effect of the sewage resting in our No. 1 filter bed was distinctly and progressively to reduce the colour, opacity and odour; sewage kept in the dark in a closed receptacle on the other hand showed a marked and for a time progressive increase in colour, and less reduction of opacity. As we have seen the albuminoid ammonia is reduced very considerably both for the hour and for the 24 hours period of rest in No. 1, but in fresh sewage kept in the dark in a closed vessel the albuminoid ammonia remains the same or is very little reduced after 24 hours' rest under these conditions, although the free ammonia goes up. Thus a fresh sewage was found to have free ammonia 11·0, albuminoid 0·92, ammonia and oxygen absorbed in 2 hours 6·8. After 24 hours' rest in the dark the free ammonia was 13·05, albuminoid ammonia, 0·9, and oxygen absorbed, 7·08. It would appear from this that the same changes which appear to occur in our No. 1 bed take place under these circumstances much more slowly and with less tendency to continuously progressive purification.

In order to satisfy ourselves upon this point, two separate quantities of fresh sewage were hermetically sealed and kept in

the tank for several days. The following are the mean of the analytical results in parts per 100,000.

		Free and Saline NH_3.		Albuminoid NH_3.
Fresh sewage after sedimentation	...	6·0	...	0·69
Same sewage after 24 hours	...	7·0	...	0·64
48 "	...	8·5	...	0·68
72 "	...	8·2	...	0·61
96 "	...	9·5	...	0·44
144 "	...	10·4	...	0·47
168 "	...	9·8	...	0·46
192 "	...	10·0	...	0·45
216 "	...	10·5	...	0·46
240 "	...	10·5	...	0·51

It appears to us then that upward filtration offers a better means of effecting the separation and solution of the suspended matters of sewage, and at the same time of reducing the pollution of the effluent than does any system which aims at their removal by digestion in a hollow chamber such as the septic tank. The particles of filtering material seem to form a large area from which organisms can more effectively work. A filter more completely reproduces the conditions under which the purification of polluted water is effected in nature, where anything analogous to a septic tank is unknown,

What are the results claimed for the septic tank? According to Dibdin the oxidisable organic matter was reduced 30·8 per cent., the albuminoid ammonia 17·5 per cent., whereas in his coarse bacterial filter at Sutton the oxidisable organic matter was reduced 56 per cent., and the albuminoid ammonia 58· per cent.

According to Meer the albuminoid ammonia is reduced 30·4 per cent., and the oxidisable organic matter 67·4 per cent. Our No. 1 filter, however, effects a reduction in the oxygen absorbed amounting to 40 per cent., and in the albuminoid ammonia amounting to 37 per cent., if the sewage rests in it but one hour. There is not much reason to doubt therefore that a bacterial filter is better than a tank, and doubtless analytical results would show a greater difference between the two processes if the sewage experimented with conformed more to the standard of the sewage employed in our experiments. The Exeter sewage experimented with is very exceptionally weak. The total solids of all those analyses which we have seen furnish a mean of under 60, and the volatile solids of under 30 parts per 100,000; nitrates are sometimes present in it, the chlorine is about 6, and the free and albuminoid ammonia 1·4 and 0·17 respectively.

Methods of Analysis and Standards.

Our experiments show that the value of the figures of the oxygen absorbed in four hours is not as great as many maintain; it is only an expression of that which is in a condition to be immediately oxidised, and takes no account of the pollution which has not reached that stage, and may be far in excess of that which has.

We found that both in sewage samples and in sewage effluents permanganate is reduced by them at a temperature of 80 deg. F., even when stoppered bottles scarcely larger than the bulk of the fluid placed within them are employed, in such variable and irregular quantities hour by hour up to and beyond 24 hours, that it was impossible to fix upon a period of time when it might be held that the oxygen absorbed formed a fairly approximate proportion to the entire amount of oxidisable organic matter in the liquid. Much time was spent in trying to work out this subject, but our results do not warrant more than this statement.

The presence of putrescible matter as indicated by a high figure of oxygen absorbed in two hours may denote merely that a large proportion of the dissolved impurity has been reduced to that transitional phase which immediately precedes purification of an ultimate character. In other words the oxygen absorbed figure is often more a measure of purification or of a stage of purification, than it is a term of pollution.

Nitrates are a measure not of that pollution which may be oxidised, but of that which has been oxidised and their presence gives no indication of what remains to be purified. Nor is their presence inconsistent with profound pollution even of a sewage effluent. If high nitrates are a good sign then free ammonia cannot be considered a bad one, for the only value of the nitrates depends upon their power of yielding nascent oxygen for the oxidation of residual pollution in the effluent, and this very action necessitates an increase of free ammonia by the reduction of the nitrates.

The presence of nitrates in an effluent must not therefore be regarded as in any sense an *index* of purification. With breeze and clinker we invariably got nitrates, with fine filtering material such as coal dust or granite chips they soon disappeared completely, and yet these effluents repeatedly showed higher standards of purification than many in which nitrates were present in abundance; the explanation being that there was a further burning up of residual organic matter at the expense of the oxygen of a nitrate. Abundant nitrates were found in stinking effluents which looked and acted like fermenting sewage, where the free ammonia exceeded five parts, and the

organic ammonia 1·4, where the oxygen absorbed in two hours exceeded 4 and the volatile solids amounted to 75 parts per 100,000. On the other hand we have had effluents where the albuminoid ammonia was 0·1 and the oxygen absorbed was 0·23, where no nitrates were present; and we have found nitrates in the effluent from one filter to disappear when the same effluent was collected and passed through another filter in which it had undergone a further stage of purification. The presence of nitrates appears to be very much a question of the calibre of the filtering material, as affecting the aëration of the filter. If the material is coarse, nitrates will be found even in offensive effluents, if it is fine they may be absent from an exceedingly pure effluent. The presence of nitrates is no more an indication of active bacteriolysis than is the presence of free ammonia, since both are the products of biological action, and can be produced at will by modifying the conditions of filtration.

It is interesting to note in this connection that in a filter constructed of granite chips, where practically no nitrification occurred, the filter gave off free ammonia far in excess of a filter constructed of coarse breeze, where nitrification was very active.

The evidence of purification, as afforded by good physical characters, is added to by the presence of oxidized nitrogen only if the organic nitrogen is low; and standards should not be based upon estimations of the amount of oxygen required to partially purify and the amount available in combination with nitrogen for the reduction of residual pollution, but rather on an estimation which finds expression in neither of these figures, viz., that of the total organic nitrogen in the effluent. The albuminoid ammonia figure is a fair indication of the organic pollution, but the organic nitrogen as estimated on Kjeldahl's principle is a much more inclusive estimation than the albuminoid ammonia, and it is almost as easily arrived at. Although it will be found that the organic nitrogen of Kjeldahl's process averages a little over twice the nitrogen of the albuminoid ammonia, though sometimes showing marke departures from the average, the fact that the two analytic figures do not bear a constant ratio to one another is significa and points to the adoption of the more inclusive estimati The process as we employed it was as follows: 25 c.c. effluent was made up to 500 c.c. with ammonia free distil water, a little pure sodium carbonate was added, and then means of a condenser the free and saline ammonia was distil over and estimated: what remained behind in the boiling fla generally 250 c.c. was allowed to cool and then 10 c.c. of pu concentrated sulphuric acid was added. All the water was ne

boiled off in the fume cupboard, the flask being supported on the slant. When nothing but a very pale yellow coloured acid remained, this was allowed to cool, 200 c.c. of ammonia-free water were added, and the acid was neutralised by soda hydrate solution. The flask was then connected with the condenser, and the organic nitrogen was calculated from the total ammonia which came over in the distillate.

Experiments have convinced us that a standard for effluents having a low limit of organic nitrogen is to be preferred to any standard of oxygen absorbed, or of oxidised nitrogen, or to any figure of percentage purification on the original sewage, or to any ratio between the oxidised nitrogen and the oxygen taken from permanganate in a limited period of a few hours.

It has been suggested that a standard of loss on ignition of the total solids should be established: but will any two chemists precisely agree upon the exact extent of such loss? It would besides be unfair to compare on such a basis the effluent with the original sewage. Such a comparison would indicate too small a degree of purification on account of the greater quantity of oxidised nitrogen and carbon in the effluent.

Again the practice of calculating to a uniform standard of chlorine is misleading. Thus a raw sewage with 0·74 albuminoid ammonia and 6 of chlorine is treated on Cameron's method, and a sample of effluent yielded by the process gave albuminoid ammonia 0·11, chlorine 4·5. The percentage reduction of the albuminoid ammonia is 85 per cent., and this reduced to a common chlorine standard shows a purification of 80 per cent. It is thus admitted that the effluent is not the effluent of the sample of sewage analysed, as judged by the chlorine, but that if the sewage which produced this effluent had been as strong as the sewage analysed the purification would have been 5 per cent. less. It is difficult to see on what grounds such an assumption can be based.

The fact is that no general standard applicable to all cases is possible or desirable. The best possible results must always be arrived at, and should be insisted upon with due regard to the nature of the sewage and to the conditions, volume and use of the stream which is ultimately to receive it. The standard of impurity permissible will in certain cases be very high indeed; in others a greater latitude may be conceded. It appears to us that what is most wanted is an uniform method of procedure in the taking of samples and in the performance of the analyses; as matters stand at present it is difficult to know what interpretation to place upon the results of different analysts when for any reason an attempt is made to compare their figures.

[*For discussion on this paper see page* [illegible].]

"*Quality of Sewage as influencing its mode of disposal,*" by
S. Rideal, D.Sc.Lond., F.I.C.
(Fellow).

Sewage may contain varying quantities of :—

(*a*). *Excretory substances.*

1. Solid Fæces. These consist of nitrogenous partially digested matter, together with vegetable non-nitrogenous residues of the food. The former are easily liquefied, but the latter are slow in dissolving, being gradually attacked, chiefly by anaërobic bacteria, and broken down into soluble compounds of fetid odour and into black amorphous flocculi, which slowly deposit as black sludge.

2. Urine. The main source of ammonia, from fermentation of the urea: the proportion of urine being approximately indicated by the content of chlorine in excess of the content of chlorine in the water supply of the town.

(*b*). *Household waste* :—The larger solid substances pass to the ash-pits, but the drainage of these and their washings by rain, if they are uncovered, are received into the sewers together with liquid food residues discharged down sinks. Vegetable refuse yields a liquid which is very foul and fermenting, developing butyric odours and sulphuretted hydrogen. Fragments of animal food putrefy and furnish a product allied to that from fæces. Diluting these is a fluctuating amount of soap water, varying at different days and times of the day: its advent is often made conspicuous in sewages of small volume by the white opalescence of the effluent, the alkalinity and odour—the latter occasionally indicating scents or disinfectants. Household discharges other than urine may also temporarily raise the amount of chlorine.

(*c*). *Rain and storm-water.*

(*d*). *Grit and detritus.*

(*e*). *Manufacturing waste products.*

Rainfall and Storm-water.—Although, according to Baldwin Latham, a rainfall of 0·1 to 0·2 inch in an hour increases the outflow of a sewer to five or more times its volume, there is, as Santo Crimp found in gaugings at Wimbledon, no exact relation between the rainfall as ordinarily recorded and the increment of flow at the outlet. The size, length, and inclination of the sewer also clearly influence the result. At Exeter five-eighths of the ordinary rainfall is estimated to find its way into the sewers.

Both the quality of sewage and its quantity as affected by local circumstances therefore determine the choice of a system

of sewerage. Under the "combined system" the effect of rain must not be considered as simple dilution, since the rain-water carries the washings of the surfaces over which it has travelled. Where the rock, or a clay bed, is near the surface, the showers will run off almost unchanged. From manured or peaty land there will be an addition of brown humous liquids which are particularly difficult to decolorize. In towns the street drainage even after prolonged rain is mixed with complex dust, abraded clothing and wood, castings and emanations of man and animals, and particles of soot, iron, earth, and stone, and is usually worse in character, especially from wood pavements, than an average sewage. Samples taken during rain have contained 18 to 38 parts per 100,000 of chlorine, 2 to 3 of albuminoid ammonia in solution, and as much as 80 to 120 of organic solids, suspended and dissolved.

For the safety of the sewers and the avoidance of flooding of basements, it is necessary under the combined system to construct special arrangements for storm overflow.

Without storm overflows in a sewage farm scheme the ground is liable to become waterlogged, and in a filtration process the excess of water by its volume and velocity tends to derange the purification plant, hence it is usually allowed to escape from the sewers by special outlets when above a certain amount, carrying with it a mixture of the unpurified sewage.

The combined system also involves the construction and maintenance of sewers very much larger than the volume of the regular flow requires, in order to provide for occasional contingencies. This greater capacity presents inducements to the disposal of grosser refuse which would not be tolerated in a smaller sewer, and often it is impossible—except at rare intervals—to properly flush the entire surface of these large channels.

The "separate system," in which the sewage proper is kept apart from rainfall and storm water, has conduits of such size only as to preclude the possibility of the sewage becoming stagnant therein, the size being governed by the supply in the water main, since if a given diameter of pipe supplies all the water needed, a little above the same diameter is sufficient as an exit; provided it is remembered that eight per cent. of the total flow may pass in one hour.

Storm water passing rapidly off the land carries with it disease germs, as is shown by the repeated occurrence of epidemics when a sudden storm succeeds a period of drought. But the liquid is ordinarily supplied with abundance of the liquefying and oxydising bacteria which, if it be allowed to subside in auxiliary reservoirs, will effect its purification rapidly,

aided by the oxygen derived from the air, and by the nitrites and nitrates that rain water always contains. The sand, chalk, or especially the clay, may be a long time in subsiding, but when deposited will leave the water comparatively pure, and fit for flushing sewers, watering roads, or for supplying the deficiency in rivers during dry seasons.

Whatever system be adopted the raw storm water of populous districts should never be allowed to pass in large volumes directly into a stream.

I may give from my own analyses an example of the influence both of the time of day and the rainfall on a strong sewage from one source.

Table showing Influence of Rain on Quality of Sewage.

PARTS PER 100,000.

Time and Circumstances.	Flow in gallons per 24 hours.	Solids in Solution.	Cl.	O consumed.	Free NH_3	Albd. NH_3	Nitric N.	Nitrous N.
Dry weather, no rain.								
10 a.m. to 5 p.m.		77·5	12·25	7·23	8·0	1·5	None.	None.
6 p.m. to 1 a.m.	54,000	45·0	6·25	6·91	2·90	0·6	"	"
2 a.m. to 9 a.m.		34·0	4·25	5·57	0·90	0·35	"	"
	Total Chlorine—41 lbs. per day.							
Heavy storm.								
10 a.m. to 5 p.m.		54·4	7·75	3·58	11·5	4·12	·056	None.
6 p.m. to 1 a.m.		45·6	5·25	2·66	3·5	1·75	·014	Trace.
2 a.m. to 9 a.m.	79,000	34·4	3·75	0·74	4·5	5·5	Trace.	Very heavy.
	Total Chlorine—44 lbs. per day.							

Physical Characters.—Dry weather: Thick and fetid, fragments of paper and lumps of fæcal matter abundant.
" " Heavy storm: Turbid, yellow-brown, earthy odour.

In the morning, urine is prominent, as shown by the chloride and by other signs; later on soapy water makes its appearance, with a white scum of fatty lime salts that tends to clog filters and leave a greasy deposit on channels; fixed alkalinity also appears, with an increase in the sodium salts; subsequently the sulphuretted odour of vegetable washings is evident, and the liquid may even become temporarily acid. The road detritus and heavier matters are usually caught in a grit chamber, while paper, string, and animal and vegetable fragments are commonly carried forward with the mixture, which rapidly becomes black, alkaline, and putrescent.

Crude sewage passed direct on to a filter bed will usually

cause fouling of the upper layers and an obstruction to the entrance of oxygen, so that the surface requires scraping and renewal with a frequency proportional to the amount and character of the solids. The following analyses show the alteration occasioned by mere mechanical straining or filtration. They are averages of thirteen hourly samples from 6 a.m. to 6 p.m. taken from different sewers of a large town on the water closet system in 1897.

Table showing Variation in Quality of Sewage in different sewers of the same town.

Parts per 100,000.	Organic N.	Solids.	Cl.	Free NH_3	Alb. NH_3	O consumed.	Nitric N.	Nitrous N.
A.—Dissolved	7·21	94·0	20·8	6·5	3·1	5·34	·096	None.
Suspended	6·18	35				5·86		
Total	13·39	129				11·2		
B.—Dissolved	5·56	57	11·1	5·0	1·6	5·86	·12	None.
Suspended	3·71	51				9·38		
Total	9·27	108				15·24		
C.—Dissolved	7·2	72	12·7	7·0	3·65	6·59	·08	None.
Suspended	1·55	60				7·68		
Total	8·75	132				14·27		
D.—Dissolved	11·33	90	12·0	7·0	2·05	8·67	·12	None.
Suspended	1·85	45				5·28		
Total	13·18	135				13·95		
E.—Dissolved		66	10·4	5·5	1·53	5·41	·14	None.
Suspended		33				3·39		
Total	11·12	99				8·80		
Average—Dissolved ..	7·82	76	13·4	6·2	2·39	6·37	·11	
Suspended	3·32	45				6·32		
Total	11·14	121				12·69		

These examples show that the suspended solids contain about one-third of the organic nitrogen and half the carbonaceous matter of the sewage. It is easily seen that in systems where they are removed by sedimentation or by filter-presses, a "*sludge*" *will* be produced which is highly putrescent and

[illegible]

dissolved in simpler forms all the solids and liquids, which were present in the raw sewage, minus the considerable proportion that has disappeared by being converted into carbonic acid, marsh gas, hydrogen, and nitrogen. I estimated that in the Exeter septic tank of 50,000 gallons about 12-15 lbs. of organic carbon (corresponding to 2-3 parts per 100,000) are completely oxidized each day to carbonic acid and removed in solution as the tank effluent, in addition to the gases evolved in the tank, which are considerable.

In the Dibdin or Sutton process, in which the sewage is pumped on to beds of coarse burnt ballast, 4 feet in depth, allowed to stand for two hours, and then discharged and the bed allowed to remain "full of air" for 5 to 7 hours, the object aimed at is aërobic, but the primary process is still a septic one. I have shown that in the Exeter filters a large volume of CO_2 and N was given off in the filters, and as a number of the liquefying bacteria are facultatively aërobic, I am still of the opinion that, since the breaking down of solids is mainly a process of hydrolysis without the necessary presence of oxygen, it is better to carry out the *preliminary* liquefaction in a closed space than in an open bed. I believe further that the "resting full" period necessary in the Exeter filter and the Sutton beds is only necessary because the anaërobic change is not completed before. Pichard (C. R. CXIV., 490) has shown that humus is not readily attacked by nitrifying agents, so that the bacterial hydrolysis should be as complete as possible in the first stage. Nitrification is simply the conversion of ammonia into nitric acid in presence of air, and it should therefore be the object of all systems to get the organic matter of sewage *entirely* resolved into ammonia before the final oxidation upon the filter bed.

Where then a concentrated sewage with a large proportion of coarse organic solids is to be dealt with, a septic system is indicated for the initial treatment, as requiring no previous screening nor settling basins, no large acreage of land, and as effectually settling the difficulty of sludge. Although fæces contain considerably less organic soluble matter than urine, yet owing to the fact that they are composed to a large extent of cellulose and other materials not readily broken down in the alimentary canal during the short period they remain there, they will always, in common with vegetable matters, peelings, stalks, paper, rags, etc., occasion great difficulties in any system of treatment except a septic tank or roughing filter, in which as we have seen, they are easily broken down by the bacteria. One strong reason for dissolving the solids is the deposit they form on the banks and in the slower parts of the streams. The Exeter tank has shown that ballast or stones are not necessary *in the first part of* the process, whilst upward roughing filters

still commend themselves to others. Tl
whether the sewage proceeds from midden
towns. The average figures for these, as
Pollution Commissioners, show no very con
composition, while in earth-closet localities
was observed (Frankland).

It seems as if the inclusion of solid exc
the water used for their carriage, and t
much of the chlorine of urine soaks into tl

Parts per 100,000.

	Solids.	Cl.	Org. C.	Org. N.	NH_3
Midden Towns	82·4	11·54	4·18	2·97	5.43
Water-closet Towns	72·2	10·66	4.70	2·20	6·70

Back-to-back houses, where such an
tolerated, by decreasing the influx of flusl
concentration to the sewage. Although
large sewers does not vary much, a hot a
causes a greater foulness and a more rapid
circumstances, that modify the quality or
are the size of the flush in water-closets
public urinals. The behaviour of urin
different from that of mixed sewage,
considered.

In the case of manufacturing towns i
that the large amount of effluent which re
from dyes, impregnated with special foul c
or alkaline from chemicals would be
purification. The Local Government B
late, declined to sanction schemes for the
disposal of districts unless the manufact
effluents to a preliminary treatment befo
the sewers.

Since the various Public Health Acts l
tion it has been found possible and even re
facturers to utilize such waste products,
the North of England, there is frequentl
through this cause.

On the whole, however, the effect of t
greatly exaggerated. In the case of smal
round factories the domestic products

proportions, and the effluent must be treated specially by chemical methods and not as a sewage proper. In large towns these discharges are usually so largely diluted that they cannot interfere with a bacterial process when rightly carried out.

It has been said that the antiseptic action of some chemicals would arrest the bacterial changes. But by actual cultures it has been shown that the amount of disinfectant required to kill or even inhibit the organisms is far in excess of what can be present in the mixed sewage. For example, at Yeovil, where arsenic as sulpharsenite of calcium is derived from the refuse of glove-making, I found that the maximum quantity of orpiment, As_2S_3, that could enter the sewers per week, if the whole amount escaped, was 2 cwt., equal in 120,000 gallons of sewage daily to 3·9 parts of As_2O_3 per 100,000, or ·003 per cent., whereas Miquel observed that 0.6 per cent. of As_2O_3 was required to prevent bacterial growth, and Frankland and Ward assert that it has little effect on lower forms of life.

As an instance of an acid effluent, I found that a soap works at Exeter was discharging ½-ton of acid liquor daily. Even if this contained 1 per cent. of sulphuric acid, it would amount on a million gallons of sewage to 0·1 parts per 100,000. But crude sewage has sufficient alkalinity to neutralize more than this amount of acid, provided the latter be not supplied in spurts as when poured direct on a filter. I have already remarked on the beneficial mixing and "smoothing" effect of the septic tank on the great fluctuations that occur at different times in all varieties of sewage. I believe that the same natural neutralisation and precipitation would dispose of most metallic admixtures such as iron salts, galvanizing pickle, &c.

With regard to tanning refuse, the antiseptic power of tannin itself is very small, and, moreover, it does not pay to let much of it escape. At Exeter I estimated the daily quantity from the large tannery in that town as equivalent to that in six fluid ounces of brewed tea per head of population, and it certainly could have no influence.

Effluents containing animal or vegetable matters, either suspended or in solution, as those from breweries, starch factories, &c., however foul and unfit to be discharged into rivers, present no difficulty to bacterial treatment, as the large numbers of the liquefying bacteria which they contain contribute to the efficiency of the process.

Popp and Becker (Chem. Hyg. Inst., Frankfort, 1896) found that "liquefying bacteria" were killed by 0·5°/₀ of sulphuric acid or by 1°/₀ of sodium carbonate, an acidity or alkalinity respectively that would be higher than the ordinary factory runnings, and would be brought down when mixed with the *whole of the sewage* to an unimportant factor. As an example

I ascertained that at a certain paper mill 35lbs. of soda-ash were used daily: the maximum addition to the alkalinity of the whole daily sewage was 0·3 parts per 100,000 or ·0003 °/₀.

Gas liquor and the effluents from timber works often contain a large quantity of suspended tar, which clogs up filter beds and presses, and fouls the catch-pits and sewers. Therefore they must usually be excluded. The floating tarry film may possibly somewhat hinder the activity of the upper bacterial layer of a septic tank, but the aqueous liquid itself in its dilution would not be likely to interfere either by its sulphides, cyanides, ammonia or tar-acids, inasmuch as many bacteria generate, and live in a medium impregnated with, ammonium sulphide, while cyanogen compounds are far less poisonous to lower organisms than to higher animals, and the strongest of the tar derivatives are not bactericidal, under 0·5 °/₀, or 500 parts per 100,000, an impossible amount to be present.

In exceptional cases, however, where intense acidity or other strong admixture cannot be avoided, the use of lime and a settling tank would become necessary.

The time of sojourn for an aërobic decomposition must vary with the age of the sewage. Many sewages require very little such change, so that the preliminary process is resolved into one of settling, and of ensuring a liquid of more uniform composition for the filter beds. Where the sewers are steep, and not more than half to one mile in length, the house discharges come very quickly down with little appreciable alteration, whereas an old sewage which has undergone considerable fermentation and hydrolysis by meandering through a long old sewer of somewhat sluggish flow, will scarcely require much stay in a tank except for purposes of mixing, and may almost be trusted to a well-aerated filter bed alone, especially if a large amount of free ammonia be present and the nitrification be carefully maintained. Where, on the other hand, "albuminoid ammonia" is predominant, a longer stay in the tank and an encouragement of further septic change is desirable, as although there are many aërobic or facultative bacteria which will change "albuminoid" into "free" (and gases) in a filter designed to have a "resting full period," it is better that this change should precede nitrication in a separate plant.

Laundry effluents and excessive quantities of slop water such as emanate from large institutions are often troublesome on account of their greasy deposit of lime soaps which soon become fetid. If passed on to filters the scum has a great tendency to produce clogging and to hinder oxidation. But under alkaline anaërobic conditions, such grease becomes emulsified by admixture with other solids, and will be attacked and dissolved as ammonia salts. They should however proceed to the works w

far as possible without dilution with other water, and with a rapid flow, to avoid deposition outside.

A question frequently raised is the possibility of an effluent conveying disease germs. By this time it is well known that fortunately pathogenic bacteria as a rule do not thrive much below blood heat, and that they are rapidly crowded out and destroyed by the ordinary bacteria existing in common waters and still more by the immense numbers present in sewage. I need hardly refer to the fact that the typhoid bacillus has only in rare cases been found even in waters and sewages to which it must obviously have penetrated. This disappearance is clearly explained by some experiments of Dr. Sims Woodhead at Exeter, when he found that crude sewages containing about half a million organisms per cubic centimetre, when inoculated into the filtered effluent of a septic tank developed more than a 1000 millions in five days, thus overwhelming any pathogenic bacteria that might be present. In the same Local Government Board enquiry Dr. Pickard specially investigated the typhoid microbe, with reference to the action on it of crude sewage, and to the effect of a filter bed on those germs which had survived a short exposure. He concluded that the sewage itself even when sterilised "was not only a bad food, but an actual poison" to these bacteria, that in the septic tank they suffered a rapid destruction, and that the filter beds effect a further biological elimination, "so that there is no chance whatever of the filtered effluent causing typhoid fever if passed into the river."

Strong Sewages, smaller in volume but more concentrated in organic matter, require special consideration and sometimes a separate treatment. If admitted untreated into minor water courses, the local pollution is evident and will give rise to legal troubles. Among natural effluents that are exceptional in concentration, those from moors and bogs are frequently strongly brown in colour and devoid of dissolved oxygen; the humous matters being singularly stable have occasioned, especially in America, serious difficulties in all systems of sewage filtration by rendering the effluent coloured, and increasing the "oxygen consumed" figure, and possibly the "albuminoid ammonia," which are relied on in judging from arbitrary standards. A chemical treatment with lime, or lime with aluminium or ferric salts, is found to furnish a clean, colourless, and particularly pure effluent, which in this case would actually have its value as a drinking water.

On the other hand an effluent from works or large institutions, the flow from a collection of houses on the midden or earth-closet system, or the runnings from farmyards, piggeries, and ditches of highly manured land, will often by the odour and yellow coloration show that the main constituent is recent urine.

Such a liquid is eminently unsuitable for either precipitation or passing through a porous filter of any kind, or even for placing on land until the first change, the hydrolysis of urea into ammonium carbonate, has been effected by organisms. The liquid will even then be so loaded with ammonia that it will not readily undergo nitrification: its tendency in fact will be to *reduce* any nitrate already formed into nitrite and nitrogen or its lower oxides, and to derange all systems of filtration through porous materials. For a strong or urinous sewage of this description, a preliminary detention until fermentation is completed is obviously essential before being diluted with naturally oxygenated water as when discharged into a river, or before being admitted to a nitrifying filter, and in this latter case without special precautions the nitrification may be slow and incomplete.

It is also important to remember, as pointed out in a former paper (Journ. Soc. Arts, Dec. 19th, 1897), that the changes in the natural purification of sewage lead more to the production of *Nitrites* than of *Nitrates*. For the group of transformations working to this end, I use the term—

Nitrosification, implying the production of nitrites and of nitrogen and its lower oxides by partial oxidation, as distinguished from the special reduction of nitrates called "denitrification," which was proved by Gayon and Dupetit to be "a fermentation involving direct burning up of the organic carbon at the expense of the oxygen of a nitrate." Nitrosification is not nearly so delicate a process or so difficult to initiate or control as nitrification, which it seems to invariably precede. It occurs best in the presence of diffused light and of a moderate amount of air, and is quite consistent with the growth of large numbers of green or brown algæ which are at the same time engaged in reducing any nitrates present. The following experiments show some of the conditions of the changes.

Experiment 1.—Nine volumes of a tank effluent free from nitrate or nitrite were mixed with 1 volume of a coke breeze filtrate containing 4·34 parts per 100,000 of nitric nitrogen (no nitrite), sealed in a flask without air, and kept for five days in a dark chamber at 150° C. By this time the whole of the nitric nitrogen, amounting to 0·434 parts in the mixture, had disappeared, *without formation of either nitrite or free nitrogen.* The same liquid afterwards in a vessel partially full and exposed to light yielded nitrites in abundance.

Experiment 2.—A strongly urinous effluent to which potassium nitrate had been added in the proportion of 10 parts per 100,000 was seeded with the organisms (collected by a Pasteur filter) from a coke-breeze filter, and kept *in the dark* at room temperature in bottles nearly full. After 14 days the liquid was

Diagram 1.

SHEWING CHANGES WHICH OCCUR IN SUCCESSIVE STA(

ASHTE

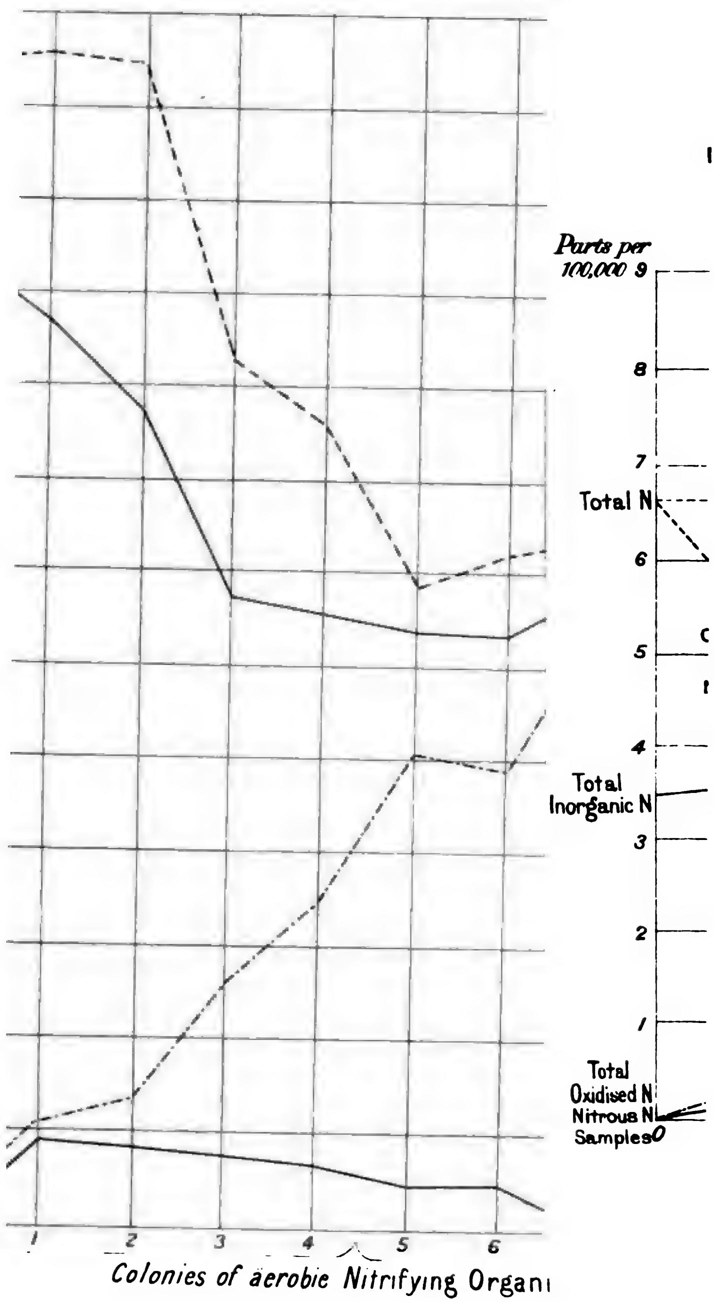


Diagram 11.

Second Series Feby 8th 1898.

NITRIFICATION IN BACTERIAL TRAYS (SCOTT MONCRIEFF SYST

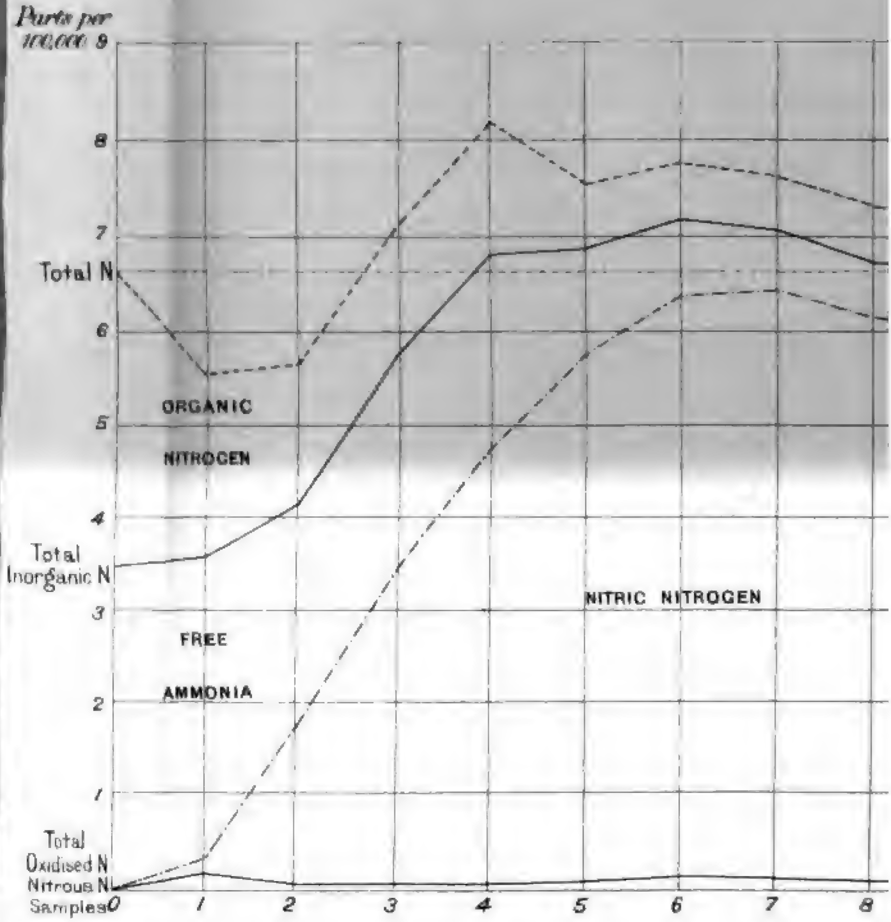
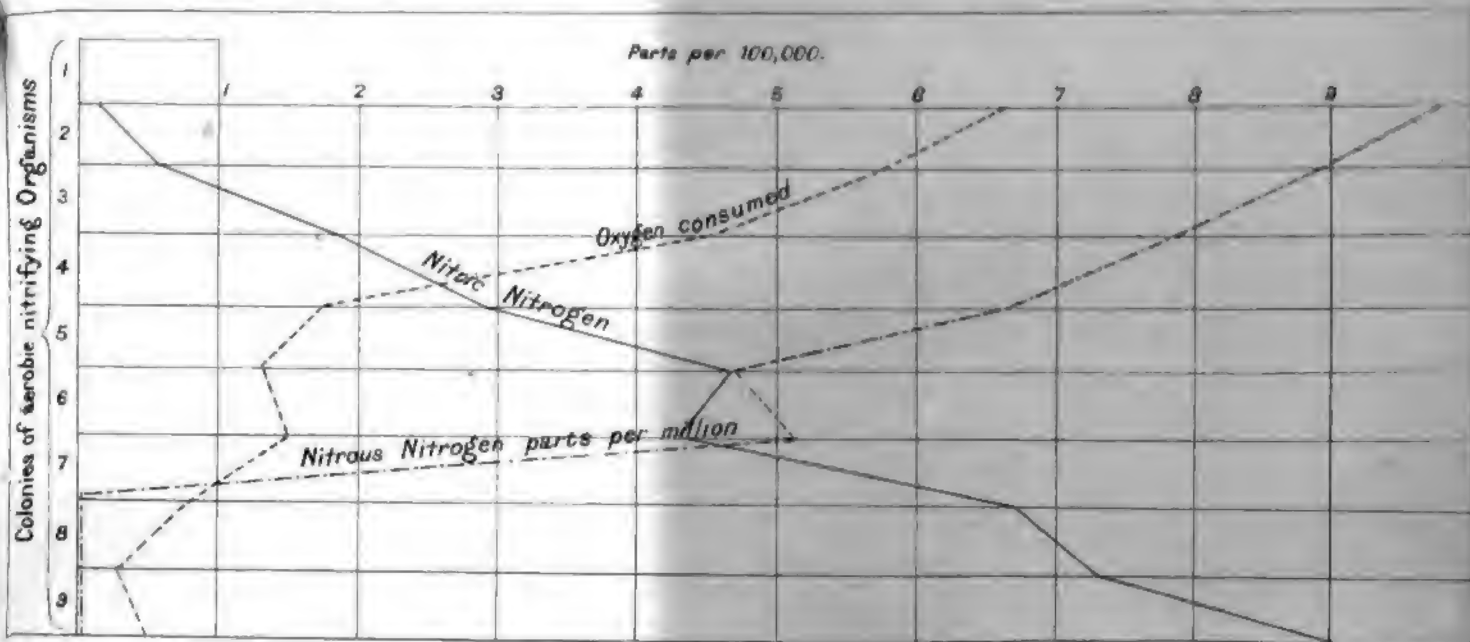


Diagram III

CHART SHEWING CHANGES IN SUCCESSIVE STAGES OF PURIFICATION.



SEWAGE FILTER TANK (SCOTT MONCRIEFF)

Diagram IV.

FIG. 1

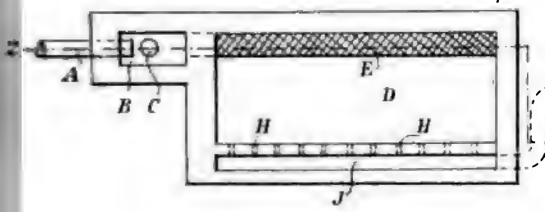


FIG. 4

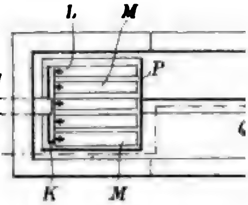


FIG. 2.

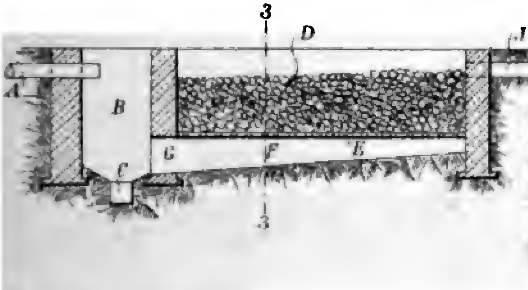


FIG 5

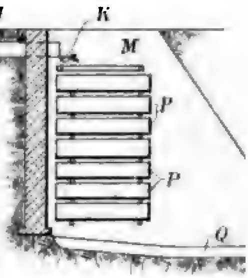


FIG 3.

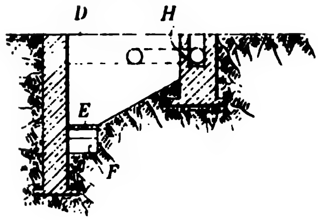


FIG 6

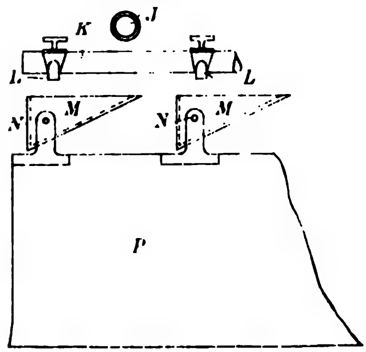


Diagram III

CHART SHEWING CHANGES IN SUCCESSIVE STAGES OF PURIFICATION.

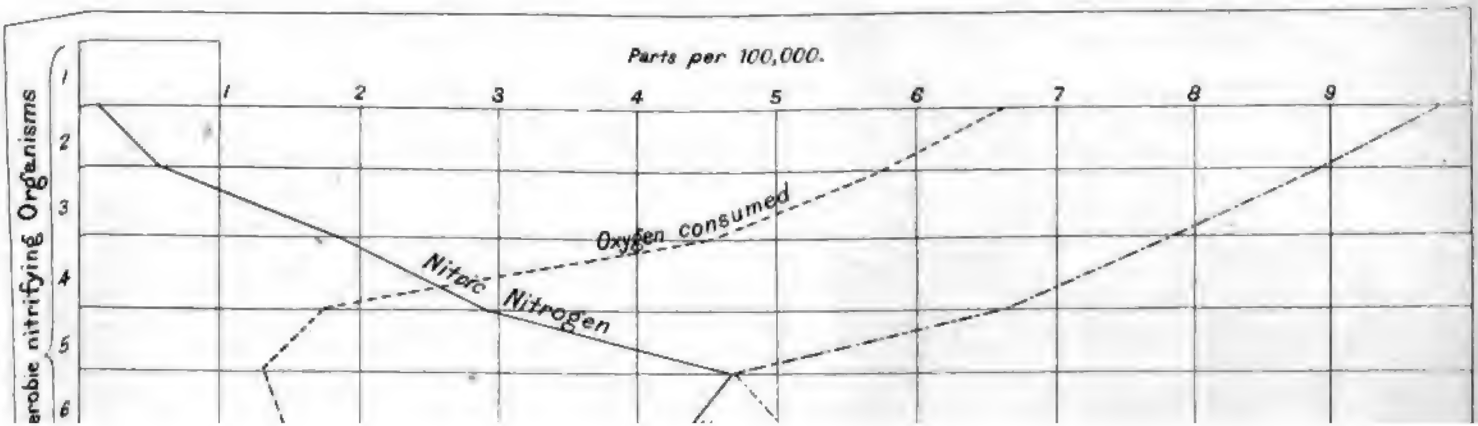


FIG. 3.

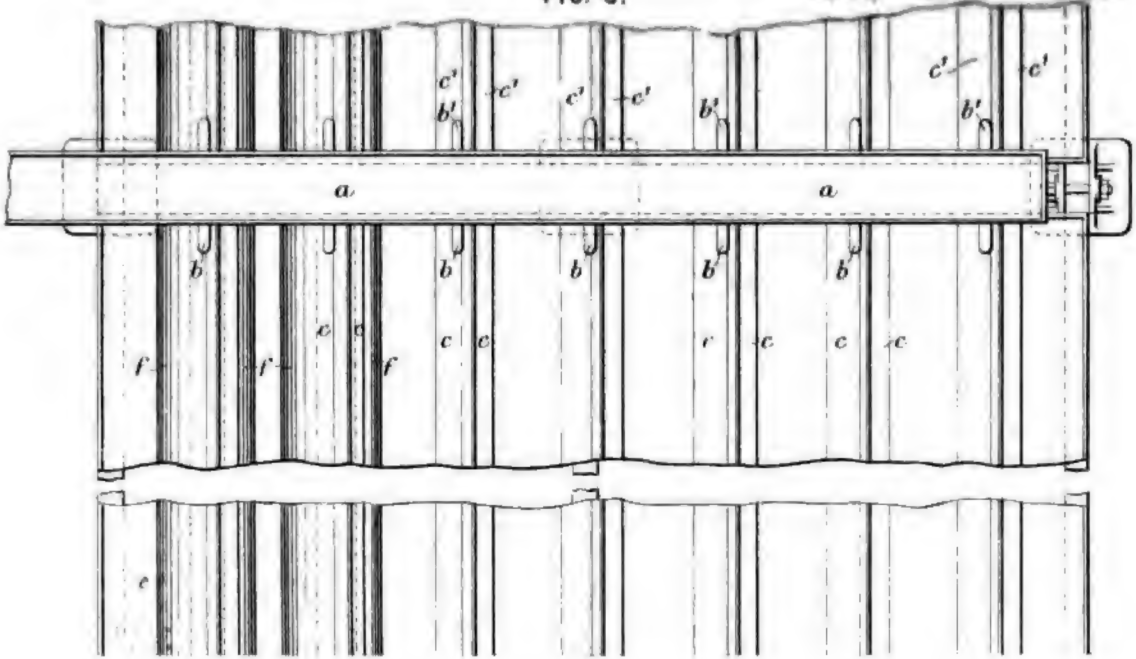
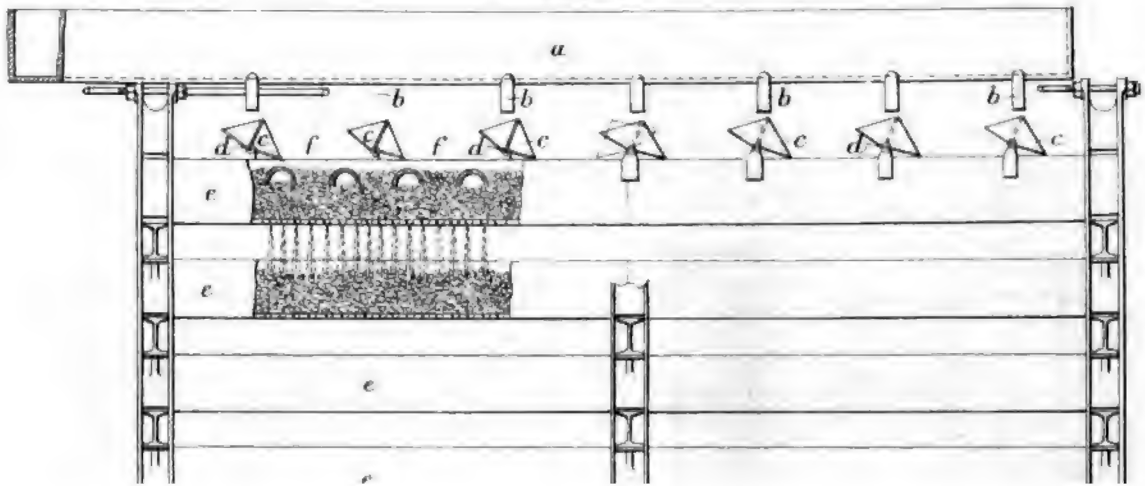


Diagram VII.

FIG. 4

Diagram V.

FIG. 2



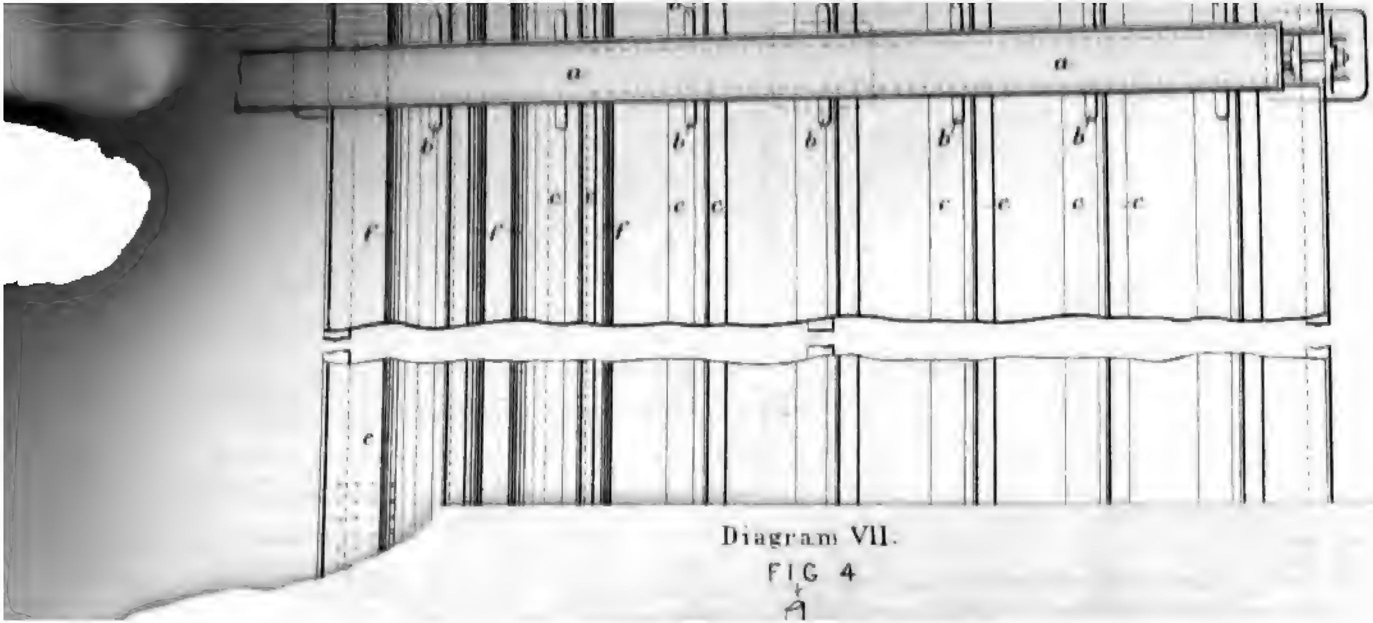


Diagram VII.

FIG 4

A

Diagram V.

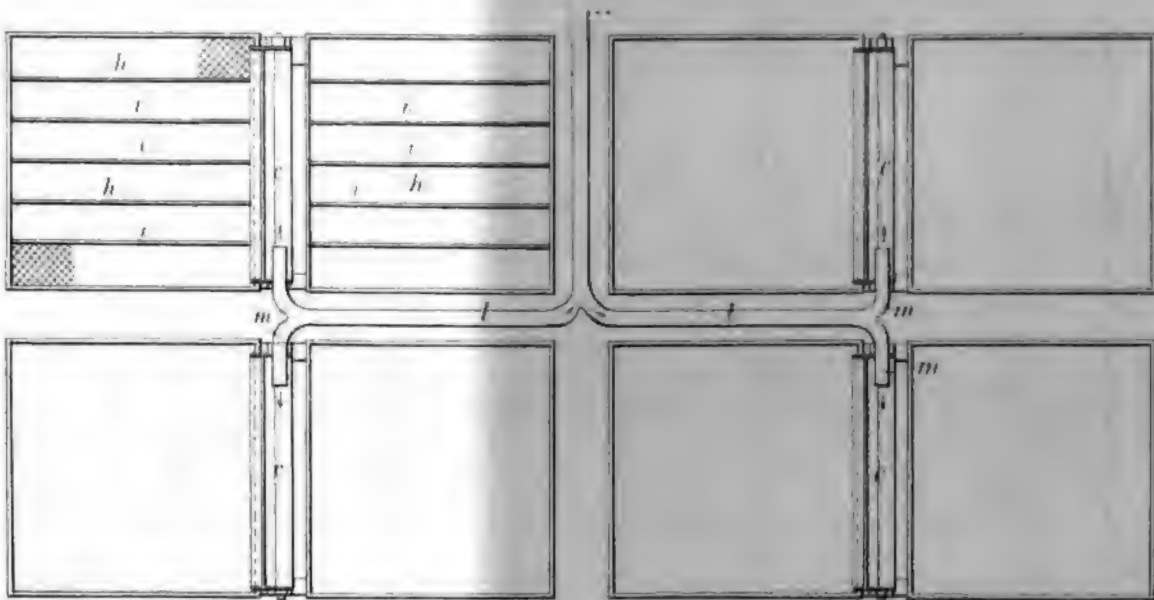
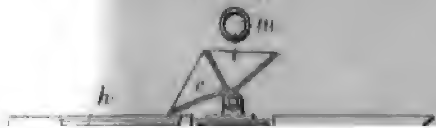


FIG 5.



turbid and had a sweetish urinous odour: a partial vacuum had been produced, as air entered freely on easing the stopper. The composition before and after was in parts per 100,000:—

	Nitric N.	Nitrous N.	Free NH_3	Org. N.	Loss of N in other forms.	Physical Characters.
At commencement..	10	0	8·0	2·89	...	Yellow, turbid.
After 14 days........	7·06	1·77	7·5	2·38	1·17	As above, odourless.

In one day the formation of nitrite from nitrate in the dark was found to be equal to 0·21 parts of nitrous N. per 100,000.

Experiment 3.—A urinous effluent similar to the above preserved in a closed bottle containing air *in diffused daylight.* Analyses:—

	Cl.	Nitric N.	Nitrous N.	Free NH_3	Org. N.	Loss of N.	Physical Characters.
Original.......	23·5	None.	Trace.	35·0	6·17	...	Yellow-brown, turbid, odour very foul, urinous.
After 67 days	23·5	Trace.	1·87	34·5	3·30	1·0	Much less colour, deep brown flaky sediment, slight musty odour.

At first a white bacterial scum formed, but later sank with the sediment. No algæ were visible.

Experiment 4.—The result of the last experiment was diluted with four times its volume of tap-water, containing 7 cc. of free oxygen per litre and 0·2 parts per 100,000 of nitric nitrogen, and preserved in the light in a half-full bottle. In five days it was clear, inodorous and nearly colourless and had only a very slight deposit in which green algæ had made their appearance. But the nitrosifying change was still prominent: the nitrous N had increased to 3·375 parts, calculated on the original, while the nitric N in the mixture was ·091, so that nitrate had actually been reduced. After this the nitrifying organism seems to have become predominant, as in fourteen days the liquid contained 3·06 parts per 100,000 of nitrogen as nitrate, and only traces of nitrite and of free ammonia, the green alga (apparently protococcus viridis) being luxuriant, and the water clear, nearly colourless and almost devoid of dissolved organic matter.

These experiments explain the causes of failure noticed when attempts have been made to deal with raw sewage by bacterial

action without due provision for allowing the changes to take place in natural sequence.

The amount of oxygen required for the processes of nitrification and nitrosification is shown in the following table:—

For production of	One Gramme of Nitrogen requires:—			
	Grammes of Oxygen.	Litres of Oxygen.	Litres of Air.	Litres of Oxygen-saturated water at 7 cc. per litre.
N_2O_5	2·85	2·0	10·0	286
N_2O_3	1·7	1·2	6·0	170
N_2O_2	1·13	0·8	4·0	114
N_2O	0·57	0·4	2·0	57
N	0·			

So that to nitrify in an effluent five parts of nitrogen per 100,000 (1 gramme in 20 litres) will demand about half its volume of air, or about fifteen volumes of fully aerated water. This explains the comparative failure and frequent collapse of filter beds in large masses, especially if the fluid is a raw sewage or a merely screened or precipitated effluent without preliminary hydrolytic change, as with every 100,000 gallons of sewage about 50,000 gallons of air must be continuously supplied.

Contrivances like fountains, cascades, and weirs can only raise the dissolved oxygen to the saturation point of about 7 cc. per litre; although useful, if simple, like the aerator at Exeter, they are quite inadequate.

The most rapid nitrification that I have seen occurs in the nitrifying trays of Scott-Moncrieff, using the effluent flowing from his special form of upward roughing filter in which the anaërobic change takes place. The plant in use at Ashtead for a house sewage of strong character consists of nine perforated shallow trays of cast iron containing coke, supported vertically over one another at about three inches apart. It requires only about eight minutes for the liquid to pass through all the trays. In the early part of this year I collected samples from the different trays and obtained the results indicated in the annexed curves (see Diagrams I. and II., p. 697), on which I may offer the following remarks.

1. The nitrate has developed with extraordinary rapidity and to an extent that exceeds any other process known to me.

2. The nitrosification is much less marked: it rapidly reaches a maximum and then declines.

3. The free ammonia has been almost completely oxidised; at the same time the original yellowish colour, black suspended matter, and sewage odour has disappeared.

In the following table I give the other figures for the first and last stages.

	Chlorine.	Dissolved oxygen, c c per litre.	Oxygen consumed by organic matter.	Available oxygen.
Jan. 25th—Original......	9·0	......	9·84	*minus* 9·57
Last tray ...	"	......	0·39	*plus* 29·1
Feb. 8th—Original	6·3	0	9·05	*minus* 9·05
Last tray ...	"	6·84	0·44	*plus* 12·99

Thus the organic matter has been very greatly reduced for so brief a time of contact. The effluent is now in a state of rapid natural purification by means of its "available oxygen," a term I some time ago proposed for effluents rich in nitrates. We know by the researches of Warington, Munro, Adeney, Gayon and Dupetit, and others, that the oxygen of a nitrate is available for the burning up of organic matter, *provided it has been properly fermented*, as this has been. In my own experiments I have found that the large loss of nitrogen so often noticed was not accounted for by nitrous acid, ammonia, nor by nitrogen gas. Gayon and others have observed the production of nitrous oxide, which being soluble is not evolved, and has no doubt been overlooked by many observers. Therefore, to be on the safe side, I have allowed 4 atoms of "useful oxygen" to every 2 HNO_3, i.e., N_2O_5 to N_2O. Deducting from this the "oxygen consumed" figure, as representing the organic matters which are fairly easy of destruction, I call the surplus "available oxygen," ready to be drawn on to complete the purification. In the above case the quantity is obviously far greater than would be supplied by any process of mere aeration, hence such an effluent could be easily "finished" by a mechanical filter without fouling the latter, or could be beneficially applied to a small area of land, or mixed with a river of moderate volume not only without pollution, but possibly with an actual benefit to the stream.

I have hardly alluded to *chemical purification*, as I have frequently concurred in the opinion which is rapidly gaining ground that the use of chemicals is commonly a mistake. For example, in the recent Manchester report on sewage treatment, it is stated that sewages at Oldham and Swinton after treatment by ferrous sulphate and lime, failed to nitrify in large cinder filters. The result may be explained by the fact that not only does chemical precipitation remove a very large per centage of the useful bacteria present in sewage, and therefore hinders the hydrolytic change which must precede nitrification in the filters, but also that the ferrous hydrate formed, removes the whole of the dissolved oxygen from the sewage immediately before it reaches the filters, where the maximum amount of free oxygen is obviously desired.

[*For discussion on this paper see page* 717.]

"*The Biolysis of Sewage*," by W. D. Scott-Moncrieff.

(Member.)

Although I have been actively engaged in the solution of the sewage problem, upon purely biological lines, since 1891, I have hitherto refrained from reading a paper on the subject because, until quite recently, there has been a lack of facts necessary to the formation of definite scientific conclusions.

My apology for reading a short paper now, is that within the last twelve months I have not only been able to reach something nearly approaching to finality in the results obtained, but to devise a method of obtaining them which throws the whole process open to examination in detail at any required number of stages.

The state of knowledge at the time I commenced to make experiments in 1891, may be judged from the fact that the apparatus which is now spoken of as the first in England to have proved the capacity of micro-organisms to throw the organic matter of sewage into solution and produce nitrates in the effluent was referred to at that time by a high authority as dependent wholly upon mechanical causes for the results obtained. I refer to the roughing filter at the high-level outfall at Wimbledon. I mention this not with any desire to go into the general history of the subject, but to show that definite information is of very recent date; and it is hardly necessary to add that a nebulous condition of knowledge often gives rise to inaccurate statements, not to speak of still more nebulous claims to originality.

The working hypothesis of the advocates for the purification of sewage by biolysis is based upon a belief that the effete substances contained in sewage are within the capacity of nature to deal with unaided by the use of chemicals. Seeing that Nature does carry out the work of purification sooner or later without any assistance from man, and that, as a matter of fact, no great accumulations of inert effete substances exist at all, the hypothesis may be regarded as a truism, and the problem really resolves itself into the discovery of methods by which Nature can be so aided in the case of sewage that it can be purified on the largest scale at a reasonable cost, without creating a nuisance and without the use of chemicals. This is what has to be proved, not as a laboratory experiment, but as an available and practical process.

I have made use of the term "Biolysis" because the decompositions which occur in the conversion of food into its original elements are not due to bacterial processes only, but to changes

which take place in the digestive organs as well. In dealing with sewage the advocates of purely natural methods contend that after the changes which have taken place in the digestive organs, or even without them, bacteria are capable of completing the work of purification.

Now supposing there were no apparatus in existence to show that this is true, there are, nevertheless, certain facts available for forming a judgment as to the conditions which such an apparatus would have to comply with in order to obtain the best results. These facts may be arranged in the following sequence:—

1. The process of purification by biolysis is not instantaneous but gradual.

2. Dividing it into any convenient number of stages or periods, each of these must represent a different character of food supply.

3. No one kind of organism is capable of flourishing in all the different media or stages equally well.

It follows that each stage should occur regularly if each differentiated group of organisms is to work to the best advantage.

Working upon these data, the conditions theoretically most favourable would be first to sterilise the sewage, then subject it to a special cultivation of organisms best suited to throw the organic matter into solution, then when these had performed the maximum amount of work sterilise again, subject it to another special cultivation of organisms and so on. If this were done we know that the organisms employed in the last stage would be incapable of flourishing in the conditions favourable to the first stage and *vice versâ*. This fact I have been able to prove by the very simple experiment of disarranging the various stages of nitrification—placing the seventh in the place of the second, the second in the place of the seventh and so on. Now, although the process of repeated sterilisations with different cultivations between each is not practicable, it was very important to keep these theoretical conditions clearly in one's mind, because it was obvious that the principle would have to be realised in practice if the best results were to be obtained.

It had long been observed in the chemical treatment of sewage that there were greater difficulties in carrying out the process of purification after suspended matters had been disposed of than occurred in their removal.

Sir Edward Frankland in a summary of the work done in the laboratory of the Royal Commission on Rivers Pollution says: "All classes of processes are to a great extent successful in removing polluting organic matter in suspension. . . . . but

the getting rid of suspended matters is a simple problem compared with the removal of organic matters in solution." This was written years before the employment of micro-organisms had taken a tangible form. It was a strong argument for the removal of as much suspended matter as possible so that the organic matters in solution might be reduced in quantity and more easily disposed of.

This opinion becoming widely embraced by those responsible for the carrying out of sewage works led to the general adoption of precipitation of the suspended matters by chemicals as a cardinal preliminary to all further treatment. Whatever views may be held by Sir Edward Frankland in the light of recent developments there is little doubt that he would have looked upon the bacterial treatment of sewage, at the time of the Rivers Pollution Commission, with anything but favour if he had understood that the first step in the process was to throw the whole of the organic matters into solution. This would appear on the face of it to be opposed to all the prevailing beliefs because it seemed to add to the difficulty of dealing with what was generally admitted to be the most difficult part of the process. We now know that the question altogether hinges not upon the amount of the organic matter in solution but upon its instability and susceptibility to further and rapid changes in the direction of complete mineralisation, and we also know that this condition of instability can be much more easily produced by biolysis than by any artificial chemical means. As to the relative difficulty between the first and second stages of the process indicated by Dr. Frankland and very generally accepted, it is evident that if the process of throwing the matters into solution by a bacterial fermentation produced the necessary amount of instability required for a further natural process of mineralisation, the problem would be solved if this process could be completed, and it would follow that there would be no sludge, and that the effluent would be a theoretically perfect fertilising medium with all the original organic matter decomposed into the form most readily assimilated by plants. All the experience obtained from my earlier experiments went to show that the process of throwing the organic matter into solution was even more easily carried out than that of getting rid of the suspended matters referred to by Sir Edward Frankland, and the apparatus I have used is shown on Diagram I., Fig. 1 (see page 697) being a plan; Fig. 2 a longitudinal, and Fig. 3 a transverse, section of what has been generally called a "Cultivation" tank. The following is a description of the first apparatus of this kind, which was constructed in 1891 and is still in use. It is about 2½ feet wide, 10 feet in length, and about 3

feet deep at the deepest part. The entire sewage discharges and waste waters from a household of ten to twelve persons, with the exception of the grease, which is held back as far as possible by a grease trap, finds its way into one end of this tank at the point CC. The liquid portion rises through a perforated grating E, and then through a layer of flints till it reaches the level of the outflow pipe JJ, which is about 2 inches below the level of the invert of the drain AA. The depth of the filtering material is only about 14 inches.

The invariable results obtained from several installations of this apparatus proved that practically complete liquefaction of the organic matter could be obtained without trouble of any kind, and that the amount of organic sludge was a negligable quantity. Where there was inorganic detritus it had of course to be provided for by deposition in the ordinary way in a sump or catchpit. It remained to be found out whether or not the breaking up of the organic matter which occurred in the "Cultivation" tank was carried sufficiently far to insure its complete mineralisation under natural conditions by some convenient and inexpensive apparatus, and this part of the problem I found to be the most difficult. Several proofs of the sufficiency of the breaking up process were soon available. When discharging the effluent from a "Cultivation" tank into a stream of relative greater volume, I found that no perceptible pollution occurred, but that there was a fall in the quantity of free and albuminoid ammonia out of all proportion to the amount of dilution.

It will be noticed from the following analysis that the ratio of dilution could be closely estimated by the chlorine content of the effluent and that of the stream, and while the dilution was about as 3 to 1, the fall in the quantity of albuminoid ammonia was from ·25 to ·035, or about as 7 to 1, and the free ammonia as about 20 to 1. This proved beyond doubt that the organic matter contained in the effluent from the "Cultivation" tank was capable of being rapidly oxidized in the stream, and from this I argued that if channels could be provided with the same amount of dilution, they would be all that was necessary to give similar results.* The chemists however insisted upon judging the process from the analysis of the effluent as it escaped from the "Cultivation" tanks. The argument about the instability of the organic matter was never

* The method of treating sewage by dilution only has been seriously considered both in Germany and the United States, and it is now being used for dealing with the sewage of Chicago; but no notice seems to have been taken of the important element of instability of the organic matter produced by previous bacterial fermentation.

entertained at all, and although in the case above referred to, there could be no reasonable objection made to the water that was passed into the river, they said that the process must be judged from the results obtained from the apparatus itself.

Scott-Moncrieff System of Purification.

Date when sample taken, September 12th, 1893.

Description.	Smell.	Reaction.	*Clearness.*—Inches through which pearl type could be read.	Chlorine. Grs. per gallon.	Chlorine. Parts per 100,000.	Total Solids. Grs. per gallon.	Total Solids. Parts per 100,000.	Ammonia (Wanklyn). Free. Grs. per gallon.	Ammonia (Wanklyn). Free. Parts per 100,000.	Ammonia (Wanklyn). Albumenoid. Grs. per gallon.	Ammonia (Wanklyn). Albumenoid. Parts per 100,000.
Effluent ...... No.	Slightly unpleasant	Practically neutral	6·8	3·3	4·71	43	61·4	1·72	2·46	·17	·25
Brook water taken 5 yards from effluent outlet	Slightly musty	Neutral	...	2·0	2·86	38	54	·52	·74	·04	·06
Brook water taken at bottom corner, about 30 yds.	More musty than above	„	...	1·3	1·86	27	39	·09	·13	·024	·035

This impressed me more than ever with the necessity for providing more highly oxidising conditions, and also for separating if possible the various stages of the process into differentiated colonies of nitrifying organisms as already referred to. Accepting the analysis of the diluted effluent as a proof that the first stage of anaërobic fermentation was sufficient to produce the required amount of instability in the organic content of the effluent, it was evident that in sewage containing a certain amount of free oxygen the first changes that occurred would be aërobic in character, and even when all available oxygen was absent, this fact only showed that it had been used up and that some organic change had occurred as a consequence.

The process as a whole must then consist of several stages, in the first of which the available oxygen will be used up by aërobic organisms, and the second would depend upon the action of anaërobic organisms with liquifactions of the organic matter, and a conversion of its nitrogenous constituents into nitrogen as free ammonia with other changes due to the fermentative conditions.

The case could therefore be stated in another way; and the necessary sequence would be first that favourable conditions should be provided by well ventilated and self-cleansing sewers for the work of a mixed group of aërobic organisms, that the conditions should then be reversed becoming unfavourable to the aërobic and favourable to the anaërobic organisms, and that the conditions should again be reversed, being unfavourable to the anaërobic organisms and highly favourable to differentiated colonies of nitrifying organisms which are best suited to carry on and complete the final mineralisation of the organic matter by converting the free ammonia into nitrogen as nitric acid.

Presuming that the "cultivation" tank as above described was a satisfactory method of carrying out the first two stages, I give a typical analysis of the effluent obtained from it and will then go on to describe the very simple apparatus which embodies the third part of the process which again is subdivided into any required number of stages according to the standard of purification to be maintained. This analysis is shewn on the first line of the table on page 706, which gives analyses of the changes which occur during the process of nitrification.

The original apparatus was arranged as follows. I constructed nine wooden boxes with perforated bottoms, each of them two feet long by seven inches wide by seven inches deep, an allowance of half an inch on each side being made, so that each box had an effective area of one square foot through which the effluent passed. These boxes I placed one above the other upon a framework and filled each of them to a depth of six inches with coke, broken so as to pass through a ring one inch diameter. Over the uppermost box I fixed two small tilting V-shaped trays, which automatically discharged their contents when the liquid reached a level that upset their equilibrium, as they were hung upon small trunnions fixed at the proper point to effect this movement working upon supports fixed to the ends of the highest box. Over this column of boxes a large tank was fixed into which the effluent was pumped after it came through the "cultivation" tank. The flow of the effluent was so regulated and measured that an estimate could at any moment be made of the rate in terms of gallons per acre per 24 hours. Between each of the boxes there was an air space of about two inches, and a receptacle was provided at the bottom which held about twelve hours' flow. By placing shallow dishes between the boxes, samples could be taken simultaneously and a complete set of analyses of the whole series of changes could be made consecutively. The arrangement of the trays is shewn on Diagrams IV. and VII., Figs. 4, 5, and 6, also Diagrams V. and VI., page 697.

Table showing successive stages of Mineralization by Nitrifying Organisms. Ashtead Experiments, February, 1898.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
Description of Samples.	Chlorine.	Free NH_3	= N	Albuminoid NH_3	= N	Oxygen consumed	O. consumed minus O. required by Nitrous Nitrogen	Nitrous Nitrogen.	= Oxygen required.	Nitric Nitrogen.	= Useful Oxygen N_2O_5 to N_2O.	Total Oxidised Nitrogen.	Available Oxygen useful, O. Nitrate = O. consumed.	Total Unoxidised N. (Kjeldahl).	Total Organic Nitrogen.	Total Inorganic Nitrogen.	Total Nitrogen of all kinds.
Effluent from Cultivation Tank, taken 3 and 5 p.m.	9·0	12·5	10·30	1·50	1·23	9·843	9·843	Nil	—	0·12	0·274	0·12	− 9·57	12·35	2·05	10·42	12·47
1. Effluent from First Tray	9·0	10·5	8·65	1·25	1·03	6·694	5·56	0·99	1·13	0·096	0·219	1·036	− 6·47	11·5	2·85	9·74	12·59
2. Effluent from Second Tray	8·5	9·0	7·42	1·00	0·82	5·773	4·74	0·90	1·03	0·48	1·09	1·38	− 4·66	11·10	3·68	8·80	12·48
3. Effluent from Third Tray	8·5	5·0	4·12	0·60	0·49	4·493	3·60	0·78	0·59	1·87	4·27	2·65	− 0·22	6·60	2·48	6·77	9·25
4. Effluent from Fourth Tray	8·0	4·0	3·3	0·35	0·29	1·728	0·98	0·66	0·75	2·76	6·30	3·42	+ 4·58	5·15	1·85	6·72	8·57
5. Effluent from Fifth Tray	7·75	1·5	1·24	0·15	0·12	1·28	0·73	0·48	0·55	4·68	10·70	5·16	+ 9·42	1·75	0·51	6·40	6·91
6. Effluent from Sixth Tray	8·0	1·75	1·44	0·35	0·29	1·497	0·92	0·51	0·58	4·416	10·10	4·926	+ 8·61	2·25	0·81	6·37	7·18
7. Effluent from Seventh Tray	7·5	0·35	0·29	0·30	0·25	0·755	0·755	Nil	—	6·6	15·08	6·6	+14·33	0·85	0·56	6·89	7·45
8. Effluent from Eighth Tray	7·5	0·20	0·165	0·65	0·53	0·397	0·397	Nil	—	7·32	16·73	7·32	+16·34	1·03	0·865	7·48	8·35
9. Effluent from Ninth Tray	7·5	0·25	0·206	0·60	0·49	0·589	0·589	Slight trace	—	9·0	20·0	9·0	+20·1	0·60	0·394	9·21	9·60

Columns of Aerobic Nitrifying Organisms.

The apparatus was set to work on the 25th of October, 1897, and kept constantly working both night and day for about three months, this lengthy trial being made with the object of discovering if there was any tendency to clogging of the material in the boxes; everything being perfectly free from accumulations and the effluent running at the rate of a little over 1,000,000 gallons per acre during the whole period, Dr. Rideal made a series of analyses which are shewn in the table.*

The most interesting result of the experiments is the rapid conversion of the nitrogen compounds into nitrogen as nitric acid, and a high figure has been maintained throughout, varying from seven to about nine parts per 100,000. The conversion from the first line of results to the bottom line, which gives an analysis of the effluent from the ninth tray, occurs in something under ten minutes, showing the extraordinary rapidity with which mineralisation occurs when the conditions are favourable. By transposing the trays so as to upset the natural survival of organisms in the sequence the whole process was arrested, a high coloured and inferior effluent being the immediate result, and one or two days were required to re-establish the conditions which had been disturbed.

It occurred to me that that the arrangement as described could be used to obtain graphic illustrations of the changes as they took place, and the nitrogen lines are shown upon Diagram I., p. 697. All the other changes can be graphically shown in a similar manner, and when these are superimposed one upon the other a complete view is obtained of how they are related to each other. The lines of increase crossing the lines of decrease afford a practically perfect method of obtaining information as to what is going on, and a curious setting back of the lines of increase with a corresponding change in the line of oxygen consumed in the case of the 5th Colony pointed to a critical state of the biological conditions at that part of the process; this is shown upon Diagram No. III., page 697.

It is a subject of great regret to me that a large installation at Caterham dealing with the entire discharge from the barracks has not been completed in time to allow of the results being brought into this paper. These I hope will soon be made public.

What appears to be certain is that full information can now be obtained both chemically and bacteriologically as to what actually goes on during the whole process of nitrification. I should add that I have made provision for discovering if possible

* The amount of albuminoid ammonia in the 6th to the 9th trays no doubt arose from some disturbance of the filtering material in taking samples.

the point to which the anaërobic changes should be carried and beyond which they ought to be arrested. Estimation by error appeared to me to be the only way of arriving at any certainty with regard to this important element in the process. With this end in view I have constructed a closed chamber in which the anaërobic conditions are greatly intensified by means of inverted glazed earthenware vessels piled up inside the chamber. As each of these forms a separate cell in which the gases of decomposition accumulate, and as these numbering over 500 are placed in the body of the liquid, and as arrangements are also made for discharging the effluent at various stages of the anaërobic decomposition over the nitrifying trays, it is hoped that some definite knowledge may be gained as to the proper point to which these first stages should be carried.

As I have already said, my apology for reading this paper is that there is now a prospect of light being thrown upon the process of biolysis at all its stages, and that we shall be no longer working in the dark.

Two analyses are given in addition to those made by Dr. Rideal, one by Sir Edward Frankland, and the other by Mr. Raymond Ross.

ANALYSIS BY SIR E. FRANKLAND, F.R.S.

Ashtead Experiments.

February 10th, 1898.	Total Solid Matters	Organic Carbon	Organic Nitrogen.	Ammonia	Nitrogen as Nitrates and Nitrites.	Total Combined Nitrogen.	Chlorine.	Remarks.
Sample of Crude Sewage ...	85·6	5·538	1·054	11·25	0	10·31	7·1	Foul Odour.
Sample of Sewage Effluent	79·3	·713	·111	·42	5·940	6·40	5·9	No Odour.

ANALYSIS BY RAYMOND ROSS, F.I.C., F.C.S., Memb. Soc. Public Analysts.

Ashtead Experiments.

Samples taken by Dr. FOSBROKE, M.O.H. for Worcestershire.

	Parts per 100,000. Sewage.	Effluent.
Total Nitrogen (Kjeldahl)	38·42	·17
Free Ammonia	11·72	·013
Albuminoid Ammonia	4·5	·075

[*For discussion on this paper see page* 717.]

"*The Bacterio-Chemical Analysis of Sewage and Sewage Effluents,*" *by* W. E. ADENEY, D.Sc., F.I.C., Curator, and an Examiner in Chemistry in the Royal University of Ireland.

Now that it has been generally accepted that the purification of polluted waters, under natural conditions, is the work of bacteria, and that all processes for the purification of sewage to be satisfactory, must conform to this fact as a central principle, the question arises: should not the methods employed for the analysis of the same waters be based upon the facts that they are fermentative liquids, and that the information we ought to seek from analysis of them is the amount of fermentative matters they contain apart from their other possible constituents.

The methods in use at the present time for the analysis of *polluted* waters were originally worked out for the examination of *potable* waters, and although experience has shown them to be trustworthy for the latter purpose, they are, as it is now generally admitted, wholly unsuitable for the analysis of polluted waters. In making this statement I should like to guard myself against any idea that I wish to cast any discredit upon the classical work of Sir Edward Frankland on potable waters, or upon the work of the authors (Messrs. Wanklyn and Chapman) of that most valuable method of potable water analysis known as the albuminoid ammonia process. It is only necessary, to dispel any such idea, to point out the fact that the influence of bacteria in nature, so far as their being the true agents concerned in the restoration of polluted waters to a condition of purity, under natural conditions, was quite unknown and unsuspected at the time the researches of these chemists were being carried out.

It has been shown by bacterio-chemical researches* that the organic constitutents of a potable water suffer practically no change by bacteria, and that the system of classification of potable waters, into good, suspicious and bad, mainly according as the organic matters they contain come within certain well defined and understood limits, is scientifically sound so long as the classification is confined to potable waters.

Bacterio-chemical research has demonstrated however with even moie force that the presence of organic matters in a

---

* See Chem. Soc. Journal, Vol. XLIX., p. 677; also Transactions, Royal Dublin Society, Vol. V., Part 11., 1895.

water which can undergo change by bacteria gives rise to an entirely different set of considerations. We then require to know, not that the quantity of organic matter is represented by a certain figure, or comes within certain limits, but what chemical changes they will undergo in the water, and what attendant influences such changes will exert in the water and everything that comes in contact with it, *e.g.*, fish and vegetable life, and also the atmosphere and public health of the neighbourhood, and how these changes may be ascertained and put into concrete form for analytical purposes.

I propose to describe in this paper a simple process for the chemical analysis of polluted waters, based upon the considerations which I have above stated. I much regret it is not in my power to deal also with the bacteriology of the problem. I can only hope that bacteriologists will themselves take up the problem and work out systematically the part of it which belongs to their subject, as I feel confident that results of great interest and practical importance will follow such study.

In order to gain a clear conception of the kind of information we require to possess concerning foul waters, let us consider the nature of the changes which the polluting matters in them may undergo during the restoration of the water to a condition of purity by natural agencies.

These changes have been fairly well worked out, at least in broad outline. It is known for instance :—

(1.) That the agents which bring about the purifying changes are bacteria.

(2.) That the germs of these organisms exist practically everywhere in nature.

(3.) That the ordinary bacteria of Nature can attack, and completely oxidise, probably most, if not all, known organic substances, with the exception of antiseptics.

(4.) That the chief condition necessary for the continued healthy life processes of these organisms is an adequate supply of oxygen in the free state or in certain forms of combination.

This holds good for the *solid* matters *in suspension*, as well as for those *in solution*.

(5.) That the chemical changes set up by these organisms, under the condition of a sufficient oxygen supply, result in the complete break down of the organic matters in a foul water, and in their conversion to carbonic acid, ammonia, water, and nitric acid, together with the formation of small quantities of colouring matters, which although organic in composition are not to be regarded as polluting matters, since they are to be found present in more or less small quantities in all natural waters, including first-class potable waters.

The process then of purification of foul waters by natural agencies is a true bacterial fermentation,—a process presenting *per se* no danger to health, if an adequate supply of oxygen be maintained during its continuation, but capable, in the absence of such adequate supply, of engendering conditions in the highest degree dangerous to health.

It is evident therefore that a method of analysis for drainage waters, to be satisfactory, must be capable of indicating the true polluting power of such a water, that is to say, it must indicate the quantity of fermentable organic matters the water may contain, the volume of oxygen which the bacteria will require to bring about their complete oxidation or fermentation, and the rate at which they will undergo fermentation.

This information is necessary, it will be observed, before we can calculate what damage any drainage water will do if discharged into a given river, and, in fact, before we can state whether the discharge of a foul water into a river will give rise to the evils of over-pollution in the river water, or not.

We may take it, from what has already been said, that a river becomes overpolluted when the bacterial fermentation in its waters becomes so rapid that the atmospheric oxygen dissolved in them is consumed by the bacteria more quickly than it can be replenished in the ordinary way, that is, by ordinary solution, and diffusion through the water of fresh quantities of oxygen from the atmosphere. When this state of things arises anaërobic fermentation sets in, attended with all the offensiveness and dangers of putrefication.

The rapidity of the consumption of the dissolved oxygen depends upon the activity of the bacteria, and their activity depends upon the quantity and kind of polluting organic matters present in the water, the greater the quantity, and the more favourable to growth of bacteria, of the polluting matters, the greater their activity, and the more rapidly the chemical changes, which they can bring about, are completed.

It will not, of course, escape the attention of the members of this Section that a method of examination, such as here indicated, raises a number of fundamental considerations.

All these fundamental points have been fully investigated. A description of the methods employed, and records of the experimental results obtained in the investigation, have already been published in the Scientific Transactions of the Royal Dublin Society, Parts 1, 2, and 3 in Vol. 5 (Series 2), Part 11, 1895; and Part 4 in Vol. 6, Part 11, 1897, under the title, "The Course and Nature of Fermentative Changes in Natural and Polluted Waters, and in Artificial Solutions, as indicated by the Composition of the Dissolved Cases." An abridgement

of these papers has been published in the Transactions of the Institution of Civil Engineers of Ireland, 1896* and 1898.

It is unnecessary for me to take up the time of the Section by making a detailed reference to the results of this investigation, as those especially interested in them can refer to them at their leisure. I need only draw attention to some conclusions which bear directly upon the particular points I wish to deal with in this paper. They are as follows:—

(1.) That the mixed organisms natural to foul waters practically behave as constant chemical factors during the complete fermentation or purification of the same under aërobic conditions; that is to say, they have been found to consume similar volumes of atmospheric oxygen during their complete fermentative action upon similar volumes of the same polluted water.

(2.) That the volumes of atmospheric oxygen consumed by the bacteria during their complete fermentation, under aërobic conditions, of a polluted water, are directly proportional to the quantity of polluting matters in the waters.

(3.) That the mixed organisms of foul waters effect the complete fermentation of the polluting matters in the same, in two separate and perfectly distinct stages.

During the first stage the organic matters are alone attacked, and they are completely changed into carbonic acid, ammonia, water, and the colouring matters already referred to.

After the completion of this stage a period of apparent rest ensues, then the second stage sets in, and during it the ammoniacal nitrogen is the central object of attack, and it is oxidised to nitric acid. The colouring matters formed during the first stage are also more or less completely converted into carbonic acid, water and nitric acid.

I have proposed to term these two stages of fermentation the carbon-oxidation and the nitrogen-oxidation stages respectively. The second stage may also be appropriately called the nitrification stage.

Time will not permit me to dwell upon the interesting considerations suggested by the above conclusions. I will only remark here that the chemical changes effected by bacteria have been found, so far as they have been studied, to come under, without exception, the principles of thermo-chemistry, and that it is not surprising therefore to find that bacteria function as constant chemical factors under the condition of a constant supply of oxygen. It is also for the same reason not surprising

* Reprinted in "Engineering," Vol. LXI., pp. 728–730 and 762–764, 1896.

to find that the carbon-oxidation or first stage of fermentation is always found to be complete before the commencement of the nitrogen-oxidation stage. We should have anticipated this from thermo-chemical principles.

Turning now to the question of formulating a method of analysis for foul waters based upon bacterio-chemical principles, it is scarcely necessary to observe that the main object of such a method must be the determination of the volume of atmospheric oxygen consumed during the carbon-oxidation stage of a known volume of a foul water. It should also be an object of the method to approximately indicate the rate of consumption of oxygen, if necessary.

I may remark here that in the rational analysis of polluted waters, for river pollution purposes, it is really only necessary to examine the first stage of fermentation, since we may assume from what has been stated, that it is only during this stage that putrefaction could be set up in a river.

The methods employed in the investigations already referred to can of course be used for the analysis of foul waters, but they are unnecessarily elaborate and slow for general analytical purposes. I have accordingly recently worked out a simple method suitable for general use. This method is carried out as follows:—

A bottle, generally an ordinary Winchester quart, is fitted with an india-rubber cork, in the centre of which a hole has been bored, and in which a short glass tube is fixed. The outer end of this tube is fitted with a short length of capillary india-rubber tubing, which can be closed, when necessary, by a piece of glass rod. The capacity of the bottle, with the cork in position, is first found. A known volume of the water to be analysed is then transferred to the bottle, and the cork securely fitted in, the free end of the rubber tube being left open. The bottle is then put aside for about an hour to allow its contents to assume the temperature of the surrounding air, and to allow also the air in the bottle to become saturated with aqueous vapour. The temperature of the laboratory, and the reading of the barometer, are then noted, and the rubber tube is immediately closed by means of the glass rod. Finally all the rubber parts are coated with shellac varnish, to prevent gaseous diffusion, and the bottle is put aside in the dark for fermentation for about four to six days.

Knowing the capacity of the bottle, the volume of the water introduced and the temperature and pressure of the air at the time of corking, and remembering the fact that the air left in the bottle is saturated with aqueous vapour, we can calculate, from the known composition of the atmosphere, the exact

volumes of nitrogen and of oxygen left in the bottle at the time of corking. Then if after the completion of the first stage of fermentation a small quantity of the air in the bottle be withdrawn by means of a suitable gas apparatus, measured and analysed, we shall have all the data necessary for determining the exact volume of oxygen consumed during the first stage of fermentation of the organic matters in the volume of the water taken for analysis.

The analysis is extremely simple, it only involves the determination of the volumes of carbon dioxide, and of oxygen, by absorption, and of the nitrogen by difference. The calculation is also very simple. The experiments recorded in the researches already referred to, show that it may be taken, with close approximation to the truth, that the nitrogen does not alter in volume to any appreciable extent during the fermentation, if the contents of the bottle be preserved at a fairly constant temperature, and if the volume of air in the bottle be not too small in proportion to that of the water.

With this assumption as to the nitrogen, we can calculate the consumption of oxygen by deducting the volume of it, at N.T.P., found by analysis to be associated with the nitrogen in the bottle, at the end of the experiment, from the volume known to be present at the commencement of the experiment.

The method, it will be observed, presents no difficulties either in manipulation or in calculation, and possesses the very great advantage of securing the examination of a water under conditions very similar to those which obtain in nature.

The gas apparatus required is also extremely simple. Lunge's Nitrometer, or Hempel's Gas Burette and Absorption Pipettes, may be employed for the purpose. After a little experience no difficulty will be found in making an air-free connection between the gas apparatus and the experimental bottle.

A few examples of analyses by this method and by the albuminoid ammonia method will perhaps be the best means of demonstrating its value.

The first four of the analyses quoted afford a very interesting study of river pollution, besides indicating the great practical value of the method as a means of investigating the nature of the polluting matters of a foul water.

The fifth example demonstrates the impossibility of the old methods to even indicate the presence of a non-nitrogenous substance in a foul water, while on the other hand it proves the capability of the new method of indicating not only the presence but also the quantity, of such a substance in a foul water, in terms of the volume of atmospheric oxygen required for its complete bacterial fermentation.

It must be noted that the matters in suspension in the samples were separated by subsidence and decantation before analysis.

Analyses of Polluted Waters showing the volumes of Atmospheric Oxygen required for the oxidation of the organic matters they contain by bacterial fermentation.

Results expressed as parts per 100,000, except the oxygen determinations, which are expressed as volumes, at N.T.P., per 100,000.

Results obtained before fermentation.

	1	2	3	4	5
N. as albumenoid ammonia	·052	·048	·09	·052	·012
N. as nitrites	0	0	0	0	0
N. as nitrates	trace	·059	·1	·03	0
N. as ammonia	·022	·19	·64	·052	·012

Results obtained after first stage of fermentation.

N. as ammonia	·02	·3	·9	·16	0
Oxygen consumed ...	229	845	2724	609	3324

Note.—In calculating the above volumes of oxygen, the composition of the atmosphere was taken to be—Nitrogen 79·1, and oxygen 20·9 per cent. by volume.

The first four samples were collected from a somewhat sluggish but fairly large river, at points selected to ascertain the effect of a number of discharges of sewage, more or less considerable in volume, along a flow of some three miles.

The fifth sample was a solution of common soap.

Sample 1 was collected at a point on the river above which for at least a considerable distance no discharge of sewage was discernable.

Sample 2 was collected a short distance lower down the river, and just below the outfall of a moderate-sized sewer.

Sample 3 was also collected lower down the river than point 1, but immediately after the discharge of a large volume of sewage into it.

Sample 4 was collected some distance below points 2 and 3.

A glance at the results recorded in the above table shows that the albuminoid ammonia determinations afford no information either as to the kind or as to the degree of pollution of the waters, but that the volumes of oxygen consumed, when considered together with the free ammonia determinations made before and after fermentation, indicate at once the state of the waters, both as to kind and degree of pollution.

For example, the results from sample 1 prove that a slight fermentation took place, but inasmuch as the free ammonia shows no change after fermentation, it is evident from what I have stated above, that the river water was slightly, but only very slightly, polluted with carbon-oxidisable substances at point 1.

The like determinations for the samples 2 and 4 show at once a decided pollution by carbon-oxidisable substances; but if we take into account the fact that 100,000 volumes of a good river water will hold in solution 700 to 800 volumes of oxygen at N.T.P., according to the season of the year, it becomes evident that the river was at neither point overpolluted in the sense above explained. It is not surprising therefore to find that these samples did not develop any offensive odours when kept in a corked bottle and out of all contact with air.

The oxygen and ammonia determinations for sample 3 indicate an amount of pollution by carbon-oxidisable bodies, which must be regarded as overpollution, from the definition of that state which I have given above. That this was the case is proved by the fact that a portion of it, which was kept in a closed air-free bottle, became extremely offensive.

If we now refer to the albuminoid ammonia determinations, it will be seen they exhibit no such indications of great variation in the degree of pollution. The determinations for samples 1, 2, and 4 show practically no variation from one another, and but very little even from sample 3.

The results obtained from sample 5 clearly demonstrate the impossibility of the albuminoid ammonia process of even indicating the presence of a large class of organic substances, viz., non-nitrogenous substances, which commonly occur in sewage and in other drainage waters, and give rise to a very active bacterial fermentation, as the results above quoted prove.

Before concluding this paper there are one or two points of detail to which it may be well for me to make some reference.

The first is as to the relative volume of a foul water, and of air-space to allow for in the bottles in which the fermentative tests are to be made. They must of course be varied according to the water to be examined, the greater the foulness the less will be the volume of the water required, or the greater will be the air-space which must be allowed for. I have found a convenient and suitable proportion to take is 1 of air to 4, 6, or 8 volumes of the water. I hope to shortly publish the record of a number of experiments dealing with this and some cognate points.

Another important detail is to decide how long the experiment be allowed to go on; a good working indication of this may be

gained from the appearance of the water itself; after it has been fermenting for a day or two the turbidity, which from the first is more or less marked, decidedly increases and continues to increase for two or three days more, according to the foulness of the water; the turbidity then begins to lessen, and in a day or two more the water becomes almost clear, and a deposit of bacterial débris settles down to the bottom of the bottle. When this appearance has decidedly set in, the first stage of the fermentation may be considered as finished.

It is advisable to dilute a very foul sewage with four to five times its volume of distilled water, otherwise the fermentation will be unduly prolonged.

It is unnecessary, for reasons I have already given, to allow the fermentation to proceed to the second stage.

As a general rule five or seven days ought to be a sufficient time to allow a water to ferment, when the analysis is required for river pollution purposes.

When the water to be examined is a sewage effluent, or a trade waste liquor, care must be taken to separate before analysis traces of sulphate of alumina or other like bodies, which exert an unfavourable influence on bacterial fermentation, and may be present in such waters. This may be effected by the careful addition of a few drops of sodium carbonate solution; after the precipitate, which is then formed, has settled down, the water may be decanted and subjected to fermentation.

[*The following discussion applies to the papers by* Dr. H. Kenwood and Dr. W. Butler, S. Rideal, W. D. Scott-Moncrieff, *and* W. E. Adeney.]

Professor Percy Frankland (Birmingham) said the numerous attendance clearly indicated the great interest which was taken in this problem of sewage disposal. It was a problem which was becoming more and more important as time went on. Certainly the sewage problem had been solved already, because where was the sewage of our forefathers? It had gone. How had it gone? Every particle had been disposed of by those processes which were so much in vogue at the present moment. In many quarters the bacteriological disposal of sewage was regarded as something entirely novel. It was of immense antiquity. It was as old as life on this globe. Sewage disposal had taken place in the past entirely by the agency of bacteria—those minute living organisms, the knowledge of whose proper place in nature had only been obtained through investigations which had taken place almost entirely during the latter half of the present century. This subject of sewage disposal, or rather of rapid sewage disposal, for that was the real problem, was primarily in-

vestigated by chemists, and he was bound to say that in their hands it attained the greatest perfection. Nothing which had been recently introduced could surpass the results which had been obtained for many years by the processes of intermittent filtration and broad irrigation. But these processes were not easily realizable in all places; and the advances made within the last few years depended upon adapting the conditions prevailing in particular places to the necessities of bacterial action. With the introduction of bacteriology they got at once an explanation of the remarkable purification phenomena obtained by intermittent downward filtration and broad irrigation, and they now asked bacteriology to supply the means of improving these processes to suit particular needs. They must congratulate themselves upon the rapidity with which this knowledge had been obtained and applied. They knew now how the various kinds of bacteria must be grown in order that they should perform the maximum amount of work of which they are capable; and having discovered this capacity, they had also discovered how to make the work most useful. It was in this respect that the papers were extremely interesting. Dr. Kenwood gave a description of very extended experiments which he had been carrying out with sewage. He referred to certain phenomena which he noticed in connection with the oxygen consumed, the free ammonia and the albuminoid ammonia which he found in his sewage purification tanks. He noticed an increase in the oxygen consumed in the first of these tanks. It seemed to him (the speaker) that the explanation was to be found in decomposition or hydrolysis rendering soluble some of the insoluble material. The disappearance of free ammonia in the new filters was also commented upon. That, he imagined, must be to some extent at any rate, due to its assimilation by the growth of bacteria which had taken place in these new filters, and until these growths were fully developed, the filter bed had not acquired its full power. Dr. Kenwood referred to the results of purification not necessarily being manifest in the result of chemical analysis, and this point had been enlarged upon by Dr. Adeney. That was a very important point in connection with the estimate which they formed of the value of these purification processes, but at the same time it was absolutely necessary that these analytical determinations should be made. As a matter of fact, what the chemist reported as albuminoid ammonia and oxygen consumed might and did refer to very different substances in different samples of sewage. In the case of sewage containing manufacturing refuse, they obtained all sorts of figures resulting from ingredients which were quite different from those present in ordinary household sewage. The real matter of importance in connection with sewage purification—in many cases, at any rate—was whether the effluent would enter into putrefactive fermentation when it was discharged into the stream. In many parts of the country that was the only point of interest. There were streams in this district, and in Lancashire—in the Mersey and Irwell district—and in most manufacturing parts of the country, which were so shockingly polluted that there was no possi-

bility of their ever being used for drinking water. What they wanted to guard against was these streams being a positive nuisance. It would suffice for most purposes to ascertain whether the effluent was capable of entering into putrefaction or not, when it mixed with the stream. It was, of course, quite possible to render a sewage effluent perfectly non-putrescible by sterilisation with chemicals, but when such a sterilised effluent mixed with the water of a stream it would often enter into rapid putrefaction. He should like to see the incubator test more generally introduced in connection with sewage purification. This should not be restricted to the the sewage effluent alone, but should be extended also to suitable mixtures of the sewage effluent with the particular stream into which it was discharged. Dr. Kenwood also referred to the retention of dissolved solids which took place in sewage purification. No doubt such retention must take place to a certain extent, but it must be watched with great care. Supposing they had sewage of a particular strength running on to one of these filters, on running the sewage off the filter, the latter, of course, still retained a large amount of that particular sewage in its pores. On then admitting a fresh quantity of sewage, of perhaps quite a different concentration, this got mixed with the previous sewage, and led to there being an apparent change in the amount of solids in the effluent; it was in this way that the great differences in the proportion of chlorine before and after treatment might often be explained. He was particularly interested to hear that Dr. Kenwood had noticed absorption of nitrogen by sewage during purification; he wished Dr. Kenwood had told them a little more about it. He was also interested to hear that the absorption of nitrogen differed according as the sewage was in darkness or light, and that there was more in the light. That was a remarkable result, and required further confirmation and explanation. Dr. Kenwood discouraged the idea that the presence of nitrates was of any importance in sewage effluents. He (the speaker) must confess that was contrary to the opinion which he held. With regard to the standard which Dr. Kenwood suggested, they must bear in mind that sewage had to be purified for two distinct classes of streams—streams which were still used for water supply, and streams which were not used for drinking water. In the case of streams used for water supply, he took it that the element which was of most importance in the purification of sewage was the removal of the pathogenic bacteria. In the case of streams which were not used for drinking water, they must have a totally different standard. Dr. Rideal's paper had brought before them a number of interesting points, one of which was that the difficulties of treating manufacturers' refuse had been greatly exaggerated. There could be no doubt about that, but the difficulties were still very real. Manufacturers sometimes were not overscrupulous, and took opportunities of turning the whole of their refuse into the sewer at a particular moment when they were likely to escape detection, and it was a well-known phenomenon at sewage works to find large quantities of such refuse coming down within a few minutes. Only the previous

day he had heard of a case in which quantities of oil had arrived at the sewage works, and had utterly defied treatment in any way. Had this oil been allowed to get into the filters, the latter would have been rendered inoperative for a considerable period. There can be no doubt communities should obtain powers from Parliament to coerce these manufacturers to distribute their waste liquors over the twenty-four hours as much as possible; and in the case of really dangerous liquids, to insist that they should undergo the process of purification before they leave the premises. Such powers had actually been obtained at Bilston, where nothing was admitted into a sewer which would either damage the sewer, or damage the living crops; and they had the additional power to exclude anything which would damage the purification process in vogue. He thought Dr. Rideal was a little too sanguine about the removal of pathogenic bacteria in the purification process. They must not lay this flattering unction to their souls that they had only to pass sewage through a few inches of coke or some similar material in order to be absolutely certain that the effluent was free from danger of this kind.

Lieut.-Col. ALFRED JONES (Finchampstead) said that, as was well known, for the last twenty-five or thirty years he had been an irrigationist, and a false idea had gone about that he believed in nothing else. He wished to make himself right with bacteriologists of the present day. Every discovery, as Professor Frankland said, only proved the truth of the intermittent systems of filtration, by land or other porous medium, being the only basis for sewage disposal. The same conditions which were present twenty years ago govern the biological processes, which are now so much in vogue. With regard to the papers, he wished to point out that the experiments therein referred to were founded on a small scale. Dr. Kenwood's experiments, for instance, were based upon sewage put in five-gallon jars. But they had to consider the practical advantages and difficulties of respective systems, they had to deal with sewage on a large scale; and, until they had one of the filters tried with all that went down the sewer, they must proceed with great caution. There was a danger of the public running away with the idea that the thing was very simple; the contrary was the experience of those who had carefully studied the subject.

Dr. CHARLES PORTER (Stockport) said there were two matters he wished to refer to. The first was the characteristically commonsense remark of Dr. Kenwood at the end of his admirable paper about the necessity, in the matter of sewage, of having regard to the conditions, volume, and uses of the stream into which the sewage is to enter. He thought that Dr. Childs, in the excellent lecture he delivered to the Congress, failed to distinguish between streams that were to be used afterwards for drinking purposes, and streams that could not possibly be so used. In the Lancashire district—the Mersey and Irwell district—there were streams which could not by any possibility in the immediate future be used as sources of water-supply, and he knew he represented the feeling of the Corporation

of Stockport and other Corporations of manufacturing towns, when he said they must not unnecessarily harass manufacturing interests by insisting upon high standards of purification simply for sentimental and æsthetic reasons. Provided there was no putrescence, after entrance of an effluent into a stream, all the requirements of public health were complied with, and anything beyond that in the way of purification was a strangulation of the trade and prosperity of the district. He had been informed by an expert chemist that the standard adopted in the Mersey and Irwell district was unnecessarily high. If that were correct, it was time the commercial interests of Lancashire entered an emphatic protest. The only other point to which he would refer was Dr. Rideal's statement as to the exaggerated effect of manufacturers' effluent. He wished merely to repeat what Professor Frankland had already said, that Dr. Rideal assumed that the manufacturers' effluents were uniformly distributed over the whole flow of sewage. That uniformity does not occur at all. The effluent shoots down at times in enormous quantities—its advent can almost be timed in some districts; and the question arose whether it could not be received and isolated at this time. It has yet to be proved that bacteriological treatment is capable of dealing with these effluents from manufactories. Mr. Dibdin had made some experiments at Leeds, but the results, so far as one could form an opinion, were not entirely satisfactory, for in his paper in the April number of the Journal of the Society of Chemical Industry, he spoke of previous treatment of the sewage being necessary or advisable in some cases.

Mr. Kaye Parry (Dublin) said that in the matter of sewage purification, engineers had been accused of sitting on the fence, and he feared that in spite of the valuable information they had received at the Congress, they would be obliged to sit upon the fence a little longer; because, although they now knew that sewage could be successfully purified on bacteriological lines, the question of cost was not yet determined. They knew it could be done successfully by means of filtration, and Dr. Adeney had also shown by his own work that it can be purified without filtration. The method he adopted was a preliminary clarification by the addition of some chemical, and afterwards the addition of a solution of nitrate of soda. This liquid took the place of filtration, and afforded that amount of oxygen the micro-organisms required. There was abundant evidence to show that good results could be obtained in this way, and he took it there was also abundant evidence to show that good results could be obtained by filtration. But, the point for engineers was this: which was the most economical as well as the best process? Much as he heard last year at Leeds, and again this year, on the subject of filtration, he did not think the question of the cost, either of the construction of the filters or of working them, had been as thoroughly worked out as it ought to be. No doubt many of them saw the report made at Richmond by the engineer of the works, as regards the cost of the substitution of bacterial filters for the chemical

process in use at the present time. These figures certainly were not very encouraging. An additional outlay on the works was required of £45,000, even if the present works were adapted to the bacterial filters; and although a saving in the cost of chemicals, and of sludge disposal of over £2,000 a year would be effected, still the working expenses were estimated at £3,795 a year, being an addition of £1,740 over the present cost. For that reason the question was very wisely adjourned for the present by the Urban Council. He merely wished to say that until the cost of the construction and maintenance of filters was worked out, engineers were not in a position to get off the fence.

Mr. A. S. E. Ackermann (Westminster) said he did not think Mr. Scott-Moncrieff had brought out quite clearly the reason for putting the inverted earthenware pots into the anaërobic chamber. If they were simply put there for the micro-organisms to cling to, they might have been put the other way up, and then they would not imprison any air, the presence of which was detrimental to anaërobic organisms. It must be remembered, however, that a "mat" of semi-solid spongy material formed on the free surface of the liquid in the anaërobic chamber. This mat contained an enormous number of micro-organisms per cubic centimetre, which was far greater than the number per cubic centimetre in the liquid itself; the mat was, in fact, the headquarters of the micro-organisms, and the greater their number, the more rapidly and thoroughly the sewage was dealt with. Now, the inverted pots imprisoned a certain amount of air, and therefore in each pot there was a small free surface of liquid where more of the "mat" formed. Owing to the rising bubbles of gas, formed by the decomposition of the sewage, the space above the free surface in the pots was practically filled with sewage gas, and hence the main object of these inverted pots was to greatly increase the free surface of the sewage in the anaërobic chamber, in fact the quantity of "mat" was increased something like 50 per cent.

Dr. W. E. Adeney (Dublin) said the subject of anaërobic fermentation was of great interest to him, but would require much time for adequate discussion. He was well aware of the great labours which the observations—which had been made for the purpose show that anaerobic fermentation can play a significant part in the purification of sewage—must have entailed. He ventured to think, however, that still more laborious work would have to be undertaken and accomplished by observers in this subject before the results, which are now claimed to be due to anaërobic fermentation, could be taken as even scientifically possible. As an instance of what he meant he might refer to the question of the source, whence the organisms would obtain sufficient energy, under anaërobic conditions, to enable them to effect chemical changes at a sufficiently quick rate to be of practical value in the treatment of sewage on a large scale. For himself, he could not see where the energy was to come from, under anaërobic conditions. Of course, when the conditions were

those attending aërobic fermentation, the source of energy was perfectly well known and intelligible. He thought those interested in the application of anaërobic fermentation to the treatment of sewage should investigate by accurate and carefully-devised experiments this and other points, which required settlement, and obtain accurate data for demonstrating quantitatively the effectiveness of anaërobic fermentation in sewage treatment, data such as are now available for demonstrating the effectiveness of aërobic fermentation. He had listened to the papers with the greatest interest; he quite recognised the importance of and the enormous labour involved in the work, and he would add a word of praise for the very skilful experimental investigation described by Mr. Scott-Moncrieff; but he also wished to add a note of warning of the danger of workingon an hypothesis alone.

Mr. Dibdin (Sutton, Surrey) said the extremely interesting information which had been placed before them in the papers must form a valuable contribution to their knowledge on the general question of the bacterial treatment of sewage. If Professor Frankland had not spoken, he would have made one or two remarks on one point the Professor referred to: that the bacteria had undoubtedly been at work ever since there had been work for them to do. The more they studied the question, the more definite and clear it became that they had been all along relying upon the action of the micro-organisms, not merely on the more minute organisms which were classed under the generic term bacteria, but also on the larger organisms classed under the head of Infusoria. The great lesson they had learned during the past few years was this: whether they used a chemical process, a bacteria process, or a specially arranged series of tanks or beds or other contrivances, they must not interrupt that continuous life action which was going on in the foul water from the time it was first produced until the final moment it was discharged into the river in a purified condition. If they treated the sewage by excessive doses of lime, by carbolic acid, or any material which would act as a disinfectant, they arrested the natural purifying action for a time, until it could reassert itself and continue its process at some point. If they arrested that action for a sufficient period until they discharged the sewage into the river, and then had not sufficient oxygen already dissolved in the river water to commence with, in addition to that which is being constantly dissolved from time to time, they would undoubtedly have a nuisance at a later stage. This nuisance was commonly termed the secondary decomposition. This secondary decomposition was frequently looked upon as a kind of second action that took place after the first stage of purification. When they looked at the question generally they began to get a very clear idea of their position, and while he strongly believed in the natural laws, and had always tried to put them into action in the best way his knowledge would enable him to do, yet he did not decry the efforts of others. Mr. Scott-Moncrieff had put the results of his investigations before them. Last year at the Leeds Congress they

had some interesting information from Dr. Adeney, Mr. Donald Cameron, and others, and it was only by a systematic review of the work done from time to time that they would gradually pass from a stage of experiment, and the day would undoubtedly arrive when all the difficulties would be overcome, and the question of sewage purification would be solved. He had been accused of being very sanguine in this matter, and he must admit he had been very sanguine. There were those in the room who would remember that in 1884-5-6-7 they had some rather sharp controversies about the purification of the Thames. He then based his faith on the living organisms in the Thames water. He and his colleagues relied not upon the expensive use of costly chemicals for the purification of the river, but upon the action of the river water itself. The capacity of the organisms in the water was controlled by the ability of the river water itself to absorb oxygen from the atmosphere and thus to store it for their use. Supposing they started with distilled water and exposed it suddenly to an atmosphere containing oxygen, the amount of oxygen taken up in the first hour would be very considerable—something like 15 per cent. of the total quantity the water was capable of absorbing, and as the quantity of oxygen absorbed in the water increased the rate of absorption decreased, so at some point a balance would be reached. As the oxygen was taken for certain purposes by living organisms in the water it would be re-absorbed from the atmosphere until the purification of the organic matter had proceeded so far that the necessity for the organisms decreased. If they kept on supplying food in the shape of sewage to that water these organisms would keep on living and multiplying. By a practical application of the bacteriological knowledge then available, they were enabled to save London a sum of at least ten millions sterling. At that time there were few people who realised that the same system upon which they based their work was applicable to the treatment of sewage in all parts of the country at all times, irrespective of quantity. Although at that time they had no encouragement from certain quarters, and had to submit to a certain amount of criticism, he was happy to think that for the last two sessions this section of the Institute had been devoting itself—and profitably devoting itself—to the discussion of the present position of our knowledge with respect to the bacteriological treatment of sewage. He was satisfied the day would come when the introduction of the bacteriological system would be the means of effecting an enormous saving to the country generally. They saved London ten or twelve millions, and there was a town not far away from where they were meeting that would probably save half a million. If they added to that the capitalised value of the reduced expense of working, the country would benefit enormously. He was speaking as much from the ratepayers' point of view as from the technical. He had the pleasure of being the representative of the ratepayers in his district, and as Chairman of the Council he had occasion to consider the question of the cost and to look at it from what he might call the other side of the table. He had, therefore, an opportunity of learning what was

passing in the minds of members as well as what was passing in the minds of experts, and in that double capacity he congratulated the Institute upon the manner in which it had taken up the question of the bacteriological treatment of sewage, and hoped that the day was not far distant when this very difficult problem would be completely solved.

Dr. D. B. Hewitt (Northwich) said he wished to say a few words about the experience obtained in the Mersey and Irwell district. The Joint Committee had been at work for seven years, and had always used the incubator test, which they considered a very safe test, as it indicated when the effluent was really harmless. The Manchester Corporation had now for two years carried on experiments in Dibdin Tanks as recommended by Sir Henry Roscoe, and succeeded in dealing with the effluent from their lime precipitation tanks, at the rate of over 600,000 gallons per acre per twenty-four hours. The experiment was continuous over the whole of that time, and Mr. Fowler, the chemist to the Manchester Corporation, stated through the newspapers, a short time ago, that these tanks were giving quite as good results after two years' working as they did a few weeks after they were put into operation. Notwithstanding that the Manchester sewage was very strong and putrescible, still the effluent from the lime tanks can be so dealt with by Mr. Dibdin's process, that it is rendered good enough to turn into a slow moving large body of water like the Ship Canal; and if the whole of the Manchester sewage had been treated in that way, the Mersey and Irwell Committee would have had no cause of complaint. The unfortunate position they were in to-day, was, that while they had an immense amount of knowledge as to the best mode of treatment, no authority had had the courage to adopt Mr. Dibdin's method and apply it to the whole of their effluent; and he believed in Mr. Dibdin's own district the whole of the sewage was not dealt with by his filters. He would be very glad if Mr. Dibdin would correct him if he was wrong, but he was informed that in Sutton only a small portion of the sewage was dealt with by Mr. Dibdin's process. They had also to bear in mind the remark made by Mr. Parry, that in considering the best practical means there must be considered, sooner or later, the question of cost. There is a limit to the cost of sewage treatment. Large corporations might have to burden the rates to such an extent as to make it unreasonable, and they must bear in mind that they had figures showing what the precipitation system costs. In London, Glasgow, and Manchester, he believed, the cost of the lime precipitation worked out at £2 per million gallons. So they had about £2 to the good, if the bacterial system be applied without chemicals. In any purely bacteriological process they could save chemicals, and the cost of putting down the very costly precipitation tanks, and they could apply that money towards putting down Dibdin's bacterial beds; and whether the bacteria were aërobic or anaërobic, they all alike purified the effluent. He should strongly advise those gentlemen interested in the chemical side of this question

to read the German investigations on the bacteriological side of the question, and they might perhaps find that some of the difficulties in the chemical results are due to the very fact that different bacilli are at work in different tanks and different beds; and that these different bacilli, by their life work, lead to different chemical results. Some bacilli had the effect of breaking up nitrates, and some of causing the formation of nitrates. He had listened with the greatest interest to the papers. Mr. Scott-Moncrieff's paper was one that would repay a much more careful study than was possible for anyone to give in the short time occupied in its reading. Dr. Kenwood's paper, too, contained an immense amount of matter which would take time to digest, and it would well repay a careful study.

Mr. Dibdin said it was a very proper question that the last speaker put with reference to the system of sewage in his (Mr. Dibdin's) own district of Sutton, as to whether the whole of it was treated on bacterial beds. At the present moment that was not so. They commenced the system of course beds two years ago. The bacterial system of fine beds had been in operation since about 1893. As far as the funds at the disposal of the committee permitted, the various beds were constructed. At the present time about one half of the whole of the sewage is treated on beds which have been erected by money saved out of the normal working. And nearly the whole would have been treated on similar beds but for the fact that they spent £600 upon experiments which had not given them the results they expected. That had put their exchequer in such a condition, that at the present moment they could not get much farther without levying a special rate; so they had applied for a loan to enable them to make the alterations to apply to the whole system, which, when completed, would reduce their working expenses about £500 per annum, as compared with the old system.

Mr. Arthur J. Martin (Exeter) said the papers contained very valuable food for reflection. In particular, Dr. Rideal had rendered a great service by calling attention to the actual effect of manufacturing wastes on the bacterial treatment of sewage as compared with the exaggerated notions prevailing as to the effect of such wastes. He would like to say a few words about the strength of the Exeter sewage. It was assumed, especially by people who had never seen the works, that the Exeter sewage was very weak. He asked them to compare Dr. Kenwood's analysis of the Finchley sewage with the first line of the table of Dr. Rideal's paper which related to the Exeter sewage, and they would find that the Exeter sewage, which was being dealt with under the septic process, was in almost all points equal to the Finchley sewage. The first line of this table did not represent the flow for the whole day, but for the eight hours during which the greater part of the sewage came down, and therefore gives a fair approximation to the strength of the Exeter sewage. Many people who saw the Exeter works in operation came to the conclusion that the sewage is a very strong

one. After a heavy fall of rain the Exeter sewage was weak, but he did not know any sewage which was otherwise under similar circumstances. He heartily endorsed the remarks made by Colonel Jones as to the inadvisability of forming drastic conclusions from laboratory experiments. As regards the process he was connected with, they did not base their conclusions on laboratory experiments, but on the result of working on a fairly large scale with the whole flow of a sewer. He said the whole flow advisedly. During dry weather or light rainfall they got the whole flow; during excessive rainfall a large amount of storm-water went into the river, as was the case with other works in the kingdom. With regard to the point that the septic tank would only deal with weak sewage, he might say that it not only dealt satisfactorily with strong domestic sewages, but also with sewage heavily charged with manufacturing refuse, as in the case of Yeovil. They had had occasion recently to deal with a liquid which absorbed between 80 and 90 parts of oxygen per 100,000, and with septic treatment, followed by two filtrations, they had no difficulty in getting a perfectly sweet effluent. They now obtained at Exeter exceedingly uniform results during the whole period of the discharge. He would like to give one or two reasons for preferring a septic tank to a cultivation filter. Unless they were dealing solely with domestic sewage under the separate system, they would have a large amount of mineral matter coming down the sewers. There would be a large amount of mud in suspension, which would not settle unless it was kept almost at rest for a long period. The effect of that mud in the cultivation filter advocated by Dr. Kenwood must be very disastrous, because it would clog up the spaces, and they could only get rid of it by emptying the filter, whereas it could readily be removed from a tank. Another reason why they preferred the septic tank was because the empty space in the tank was so much cheaper than space filled up with filtering material of any kind. It was so cheap that they were able to put in a tank very much larger than the theoretical necessities of the case demanded. In connection with this he referred to the very pertinent remark of Prof. Frankland as to the discharges from manufactories coming down, not uniformly throughout the day, but in large rushes. Mr. Scott-Moncrieff had pointed out that the effect of sudden changes was to interfere seriously with the work of the filters; but by introducing a tank which would hold the whole of the day's flow, and in which the whole day's sewage was blended, so as to give practically a uniform effluent, the work of the filters was rendered uniform; and they were not exposed to the deleterious effects of sudden changes in the composition of the sewage. One point more. Their object was not only to get rid of organic impurity, which might give rise to a nuisance; but they were dealing with a liquid which might contain also the germs of disease; and their object was to get rid of these germs, as well as to effect a chemical purification. That was another reason why they preferred a tank, which they could make as large as they pleased at a moderate cost; because it had been proved by Dr. Pickard's experiments that the destruction of organisms in such a

tank was dependent on the time they were exposed to its action. With regard to Mr. Scott-Moncrieff's paper, they must acknowledge the value of the work he had done in enabling them to trace the changes produced by the successive stages of filtration. The question of cost had been mentioned. He would like to ask Dr. Hewitt if his estimate of £2 per million gallons for precipitation works included interest on first cost, or simply working expenses.

Dr. Hewitt: That is only working expenses.

Mr. Martin (continuing) said he had made a rough estimate of the annual cost of the works which had been designed to deal with two and a half millions a day, and he found that taking not only working expenses, but 5 per cent. on the first cost, including land, engineering and all other charges connected with the works, the cost worked out slightly over £1 per million gallons treated.

Mr. S. F. Burford suggested that chemists should arrive at some sort of uniformity on the subject, for at present they were all at sixes and sevens.

The President of the Section (Dr. Sims Woodhead) said he would draw attention to the fact that a very great advance in our methods of treatment and of our interpretations of results had been made since last year. Although the story of bacteria and their relation to decomposition was now no longer a new one, it was only within comparatively recent times that the importance of localising and controlling the bacteria as they carry on their work of disintegration had been thoroughly appreciated. There were two points to be kept in mind—that the process is controlled to a certain extent, and is made to work under conditions and in a position in which it could be seen what was being done by the organisms; and, secondly, that this process by special arrangement may be made to go on more rapidly than under ordinary conditions. Those points with the data put before them, were quite sufficient to occupy members of this section until next year. The great thing was that they were gradually accumulating more accurate data. Although they still required a considerable amount of information on several points, yet they had now some facts and figures, and by a comparison of these, no doubt, still further advances would be made during the coming year. The members, no doubt, would consider the information put before them, criticise and sift it, and he hoped next year there would be as great an advance on this question as there had undoubtedly been during that which had passed. One could but be struck by the marked difference in the character of the papers. Last year to a certain extent they had to deal with generalities; this year they had definite data—sometimes connected, sometimes unconnected; but they had evidence on which further work could be done.

Dr. Kenwood (London) said he would confine his reply strictly to the one or two criticisms which had been passed on the paper

prepared by Dr. Butler and himself. They were not interested in any particular process, and their sole object in reading the paper was because they thought it contained some facts of interest, which tended to throw some light upon a very complex subject. He was perfectly familiar with the Exeter plant, having visited it more than once; and he repeated his statement that the sewage treated was exceptionally weak. He did not say but what on certain occasions it might be fairly strong, but he was dealing with the *mean* composition of the sewage of Finchley for six months; and if instead of an isolated sample they took the mean of a large number of samples as he had done, they would find that the Exeter sewage experimented with in the septic tank was exceptionally weak. He did not argue from that circumstance that the septic tank was necessarily not capable of dealing with a much stronger sewage, but that the experiments had been conducted under the most favourable circumstances. Mr. Martin dropped into the same error as Colonel Jones, in assuming that they conducted their experiments wholly on a laboratory scale. The experiments were also conducted on a scale almost as big as the Exeter experiment. Their filter tank was 24 feet by 24. Professor Frankland properly pointed out that the solids in solution might sometimes be taken to be precipitated in the filter when the loss was really due to the dilution of the sewage as it went through a filter which had previously received a weaker sewage. That was an obvious thing for them to think of, and they guarded against it. They were dealing at the time with sewage of a very constant strength, and they took the precaution to make experiments to satisfy themselves that the explanation now advanced by Prof. Frankland did not account for the loss. They had nowhere said in their paper that nitrates were not of importance. What they said was that the presence of nitrates must not be regarded as a definite sign or measure of purification; but if you get two effluents of equal organic pollution, and if in one there were ten parts of N. as nitrates, and in the other none, the one with the ten parts of nitrogen as nitrates, everything else being equal, would be the preferable effluent.

Dr. Rideal (London) said the point he had insisted upon was that the amount of "albuminoid ammonia" in a liquid, formed no evidence as to whether it was putrescible or not, as the presence of nitrates or dissolved oxygen have a beneficial influence in either retarding the putrescibility, or, if present in sufficient quantity, of preventing it entirely.

Mr. Scott-Moncrieff (London) cordially agreed with the observations made by the President of the Section on the rapid progress that was being made, and he had no doubt that the bacterial purification of sewage would soon be generally adopted as a thoroughly satisfactory solution.

REVIEWS OF BOOKS.

GEOLOGICAL MODEL OF LONDON AND SUBURBS.

By J. B. Jordan. Price 15s.

The tract represented is 20 miles from W. to E., and 16 from N. to S., being therefore of 320 square miles area. London itself is in the central part. The northerly limit reaches to Hendon, Finchley, Tottenham, and Woodford; the southern to Malden through Croydon, and to Orpington; whilst on the West we have Hampton Court, Twickenham, Isleworth, and Harrow; and on the east get beyond Ilford and Barking, and to Plumstead and the Crays.

The model is in relief, being on the same horizontal scale as the Ordnance Map, an inch to a mile; but vertically rather more than five times that scale, 1,000 feet to an inch. This vertical exaggeration is needful, as on a true scale the relief of the surface would hardly show at all on so small a scale.

The geology, taken from the maps of the Geological Survey, is shown in plain colours, the various superficial deposits, such as Alluvium, Loam, Gravel, and Boulder Clay being included.

The great point of such models is that they show the form of the ground, the shapes and relative heights and slopes of the hills, the direction, breadth and general character of the valleys. But they do more than this, for they also show the relation of the various forms to geologic structure, the dependence of the outward shape on the character and position of the beds, the cutting out of the valleys and the carving of the hills.

In the present case the following features are markedly shown: On the north of the Thames the high ground of the patches of Bagshot Sand on London Clay at Harrow, at Hampstead, and at Highgate, the last falling northward to the Drift tract of Finchley. On the south of the Thames the flat-topped gravel-capped hill of Wimbledon, the ridge of London Clay (with gravel patches) from Upper Norwood to Forest Hill, and the high ground of Shooters' Hill, with its gravel over London Clay, and the bordering flat of Blackheath pebble beds.

Turning to low levels the following are conspicuous:—The flat of the marshes of the Thames below London; the gravel-flats bordering the river in and above London, on either side, and below on the northern side, through which last flat the Lee and the Roding flow: and the flat of the Wandle on the south.

On one margin there is a transverse section through Hendon t[o] Hampstead, and thence southward across the Thames to west o[f] Croydon, and on another margin there are sections of the dee[p] borings at Kentish Town, Loughton, Oxford Street (Meux's), an[d] Crossness. Loughton, however, is not within the area, and th[e] section might well have been replaced by those at Richmond an[d] Streatham, which are in the area and also more important, fro[m] reaching to older rocks.

Models of this kind have hitherto been made of some form of papier maché, but in this case the material is tinned steel plate, and the cost of production much lessened thereby.

It is to be hoped that this model will be successful enough to lead to others being made, and that we shall ere long find such aids to education in common use.

There is one slight defect in the colouring, the colours of the sections being in part much darker than those of the map. This is probably owing to the sections having much dark shading, the effect of which is to alter the colour placed over them. In a like way dark hill-shading often spoils the colouring of geologic maps.

W. W.

A HANDBOOK OF HYGIENE AND SANITARY SCIENCE.*

In the eighth edition of this well known work, the bulk of the volume is increased, both in respect to the size of the page and the number of pages; for although it is now only some six years since the seventh edition appeared, so continuous and rapid is the advance of knowledge in the wide domain of Public Health, that in preparing this last edition the author has found a great deal to rewrite and to add.

A text-book which has reached an eighth edition does not stand in need of commendation, but it may be said that Dr. Wilson has succeeded admirably in his task of collecting reliable information from all the latest approved sources; and this edition is well worthy of the favourable reception which has always been accorded to previous editions. There are few works upon Public Health which impart instruction in so readable a form, and no hand-book, which on account of the well-balanced treatment of different subjects of varying degrees of importance, and the general accuracy of its information, may be more advantageously read by the student or consulted by the sanitary officer.

Amongst so much which is excellent in this work, one hesitates to draw attention to the only material respect in which the treatment of the subject matter leaves something to be desired; but, although there are some who will sympathise with Dr. Wilson's remarks upon the value of serum-therapy and antirabic inoculation, his views are not shared by the majority of those others whose special knowledge entitles them to an opinion, and on this account it seems a pity that they should have been given expression to in a text-book which is destined to be so largely used by students.

H. R. K.

---

* By George Wilson, M.A., M.D., LL.D., F.R.S.Edin., D.P.H.Camb. Eighth Edition. J. & A. Churchill. London, 1898. 798 pp. Price 12s. 6d.

ARTICLES RELATING TO PUBLIC HEALTH,

Appearing in the chief British and Foreign Journals and Transactions.

Abstracts of Titles classified in this List under the following headings:—

Science in Relation to Hygiene and Preventive Medicine.
Hygiene of Special Classes, Trades, and Professions.
Municipal Administration.
Building Materials, Construction, and Machinery.
Water Supply, Sewerage, and Refuse Disposal.
Heating, Lighting, and Ventilating.
Personal and Domestic Hygiene.

NOTE.—A list of sub-headings is given on page 286, and a list of the Journals from which the Titles are selected is given on page 300.

Science in relation to Hygiene and Preventive Medicine.

BERNHEIM, Dr. J. Ueber Immunisirung von Versuchsthieren gegen die Mischinfection mit Diphtheriebacillen und Streptococcen. *Arch. f. Hygiene*, Bd. XXXIII., Pts. 1 & 2, 1898, p. 35.

On the immunisation of animals against the mixed infection with Diphtheria bacilli and Streptococci.

DI MATTEI, Prof. Dr. EUGENIO. Studien über die Wuthkrankheit. I. Die experimentelle Wuth beim Wolfe. *Arch. f. Hygiene*, Bd. XXXIII., Pt. 3, 1898, p. 266.

Studies of Hydrophobia. I. Experimental Hydrophobia in the Wolf.

MEYERHOF, MAX. Zur Morphologie des Diphtheriebacilius. *Arch. f. Hygiene*, Bd. XXXIII., Pts. 1 & 2, 1898, p. 1.

On the Morphology of the Diphtheria bacillus.

OPRESCU, Dr. V. Studien über thermophile Bacterien. *Arch. f. Hygiene*, Bd. XXXIII., Pts. 1 & 2, 1898, p. 164.

Experimental studies of the Thermophilic Bacteria.

RUBNER, MAX. Notiz über die Wasserdampfausscheidung durch die Lunge. *Arch. f. Hygiene*, Bd. XXXIII., Pts. 1 & 2, 1898, p. 151.

Note on the excretion of water through the lungs.

TRUMPP, Dr. JOSEPH. Das Phänomen der Agglutination und seine Baziebungen zur Immunität. *Arch. f. Hygiene*, Bd. XXXIII., Pts. 1 & 2, 1898, p. 70.

The phenomenon of agglutination and its relations to immunity.

SMITH, CAPT. F., R.A.M.C., D.P.H. Diphtheria Bacilli in the Urine. *The Lancet*, November 19th, 1898, p. 1325.

Account of two experiments in which guinea-pigs were infected with diphtheria bacilli, with the result that the bacilli were subsequently found in the urine.

WOLFENDEN, R. N., M.D., and FORBES-ROSS, F. W., M.D. Action of Roentgen Rays upon the Growth and Activity of Bacteria and Micro-organisms. *The Lancet*, June 25th, 1898, p. 1752.

Experiments are described indicating that the exposure of the bacillus prodigiosus to the X rays greatly increases the growth.

LASCHTSCHENKO, Dr. P. Ueber den Einfluss der Wassertrinkens auf Wasserdampf- und Kohlensaüre-Abgabe des Menschen. *Arch. f. Hygiene*, Bd. XXXIII., Pts. 1 & 2, 1898, p. 145.

On the influence of drinking water on the excretion of aqueous vapour and carbonic acid by man.

LEONARD, NORMAN, B.SC., F.I.C. The Relation between the Specific Gravity and the Insoluble Fatty Acids of Butter and other Fats. *The Analyst*, November, 1898, p. 282.

Refers to the existence of a fairly constant relationship between the specific gravity and the percentage of insoluble fatty acids yielded by butter and margarine, and showing how the latter may be approximately calculated by means of a formula.

WOLPERT, Dr. HEINRICH. Ueber den Einfluss der Luftbewegung auf die Wasserdampf- und Kohlensäure-Abgabe des Menschen. *Arch. f. Hygiene*, Bd. XXXIII., Pt. 3, 1898, p. 206.

On the influence of the movements of air on the excretion of aqueous vapour and carbonic acid by man.

DAVISON, J. T. R., M.D. The Effects of Drying of the Soil upon the Public Health of Buenos Ayres. *The Lancet*, August 6th, 1898, p. 314.

Figures and diagrams are given showing, for a period of 25 years, the marked effect of the drying of the soil by drainage operations in reducing the mortality from phthisis and, still more, from tetanus.

BRODIE, W. H., M.D.; ROGERS, W. G., M.D.; and HAMILTON, E. T. E., M.D.—(Johannesburg). A Contribution to the Pathology of Infection by the Pneumococcus. *The Lancet*, October 22nd, 1898, p. 1045.

Clinical and pathological facts observed in two fatal epidemics with "Rhinitis" as the first prominent symptom, point to the conclusion that the pneumococcus extended from the nasal mucous membrane "along various anatomical channels of infection," causing pneumonia, cerebro-spinal meningitis, &c.

CAHILL, JOHN, M.D. A Note on Ptomaine Poisoning. *The Lancet*, October 29th, 1898, p. 1122.

An instance recorded in which three persons and a cat suffered from ptomaine poisoning, the former from soup made from the remains of a duck which several persons had eaten on the two preceding days without ill-effect, and the latter from eating a bone from the soup pot.

CORBETT, LOUIS, M.A., M.B. Anti-streptococcic Serum. *Lancet*, April 9th, 1898, p. 986.

At present cannot recommend such serum in human disease, but, judging from the success already attained in the laboratory, the discovery of a protective serum may be looked forward to.

——— The result of the treatment of Diphtheria by Antitoxin in London compared with that in Paris and Berlin. *The Lancet*, December 3rd, 1898, p. 1457.

Figures are given which show a much greater reduction in the case mortality in Paris and Berlin since the introduction of the antitoxin treatment, a result which is attributed to the more general adoption of the treatment.

DEWAR, Professor, F.R.C.V.S. The Utilisation of the Flesh of Tuberculous Animals. *The Journal of State Medicine*, December, 1898, p. 619.

DINGLE, CHAS. V., M.D. Account of the Middlesborough Small-pox Epidemic, 1897-98. *Lancet*, April 23rd, p. 1104.

Among other statistics, figures are given in children under 10 years only one death occurred among 41 vaccinated cases, compared with 24 deaths among 53 unvaccinated children attacked under 10 years.

GRIMES, L. A., M.R.C.S. A case of Membranous Tracheitis and Laryngitis without the presence of Diphtheritic Bacilli. *Lancet*, August 13th, 1898, p. 409.

In this case tracheotomy was performed on account of a membranous inflammation of the trachea and larynx, in which bacteriological examinations, on three occasions, failed to demonstrate the presence of diphtheric bacilli.

HEDLEY, MATTHEW, F.R.C.V.S. Tuberculosis in its relation to Public Health. *The Journal of State Medicine*, December, 1898, p. 615.

HUNT, JOHN M., M.B. On the Relation of Fibrinous Rhinitis to Diphtheria. *British Medical Journal*, October 22nd, 1898, p. 1249.

While other bacteria besides the Loeffler bacillus may give rise to membranous exudations in the nasal passages, the vast majority of such cases are due to the diphtheria bacillus. It is impossible to distinguish the one affection from the other on clinical grounds alone, reliable bacteriological investigation can alone settle the point.

HUNTING, WILLIAM, F.R.C.V.S. The Comparative Duties of Medical and Veterinary Officers in dealing with Tuberculosis in its relation to Public Health. *The Journal of State Medicine*, December, 1898, p. 627.

LACK, H. LAMBERT, M.D. Fibrinous or Membranous Rhinitis and its Relation to Diphtheria. *Lancet*, October 29th, 1898, p. 1124.

Analysis of symptoms given in thirty-six cases. General symptoms were altogether absent or very mild. Local symptoms lasted from six to eight weeks, and paralytic sequelæ were entirely absent. Klebs-Löffler bacillus found in thirty-three cases which were bacteriologically examined. Disease found to be very infectious.

MARTIN, SIDNEY, M.D., F.R.S., and HUNT, G. B., M.D. Cases of Diphtheria treated by injection of Antitoxic serum in University College Hospital during 1896–97. *British Medical Journal*, September 3rd, 1898, p. 624.

Conclusions:—1. Great reduction both in total and tracheotomy mortality. 2. Full benefit not established until fairly large doses (7,000 to 8,000 normal units) are employed. 3. Has but little effect unless given before the fourth day. 4. Not only reduces mortality but also severity.

RAW, NATHAN, M.D. The value of Anti-streptococcic serum in the treatment of some Pathogenic Infections. *Lancet*, July 9th, 1898, p. 81.

Gives cases illustrating the value of the treatment, and explains the importance of first establishing the presence of streptococci in the blood or discharges.

PORTER, CHARLES, M.D. The Influence for Evil of the Midden-Privy in the Dissemination of Typhoid Fever. *Lancet*, October 29th, 1898, p. 1120.

Five years' figures are given showing that the incidence of typhoid

fever in Stockport is nearly three times greater in privy-midden houses than in houses with water-closets. The figures are grouped in accordance with rateable value and class of closet.

STEPHENSON, F. W. M., M.B. Lead Poisoning in an Infant four weeks old. *The Lancet*, December 3rd, 1898, p. 1473.

History of a case of serious lead poisoning traced to the use of a dusting powder, which proved to be "powdered white lead."

THOMPSON, J. R., M.D. Non-diphtheritic Membranous Sore-throat. *Lancet*, May 7th, 1898, p. 1260.

Report of case with membrane on one tonsil and pharynx. No Löffler bacilli were found on two examinations, but a rod-like bacillus, shorter and thicker than the diphtheria bacillus, was found.

THOMSON, R. S., B.Sc., M.D., and BROWNLEE, JOHN, M.A., M.D. Observations on an Infectious Disease in Lascars having close relations with Variola and Varicella. *Lancet*, October 22rd, 1898, p. 1051.

A history is given of 16 cases of an affection which, although resembling both small-pox and chicken pocks, was apparently a distinct disease, and not a modified varicella due either to climatic or racial conditions.

THORNE, Sir RICHARD THORNE, K.C.B., F.R.S. The Administrative Control of Tuberculosis. *The Journal of State Medicine*, December, 1898, p. 591.

Being No. 1 of the Harben Lectures.

Hygiene of Special Classes, Trades and Professions, Municipal Administration.

CLAPHAM, F. DARE. Design for a Convalescent Home (illustrated) on the South Coast. *The Builder*, October 29th, 1898, p. 386.

Description of the design which was submitted in competition for and gained the silver medal offered by the Architectural Association.

LEEDS NEW FEVER HOSPITAL. *The Builder*, October 22nd, 1898, p. 368.

Description of the buildings.

MEADE, THE RIGHT HON. J. M. Duties of Municipalities, more especially with reference to the Housing of the Working Classes. *The Journal of State Medicine*, November, p. 542.

"THE BUILDER," EDITOR OF. The Sanitary Inspector and his Work. *The Builder*, October 15th, 1898, p. 329.

It points out that the duty of the Sanitary Inspector, while often disagreeable and obnoxious, is of the greatest importance to the whole community. Inspectors should be men of ability, integrity, and energy, and should be well paid.

Water Supply, Sewerage and Refuse Disposal.

PORTER, C., M.D. The Supervision of Public Water Supplies in the Hands of Private Companies. *The Journal of State Medicine*, November, 1898, p. 549.

Points out the desirability of sanitary officials obtaining powers of entry upon gathering grounds or water-works, the right to take samples, and the right to make a general inspection from time to time.

MALVOZ, E. Les Microbes des Eaux dans la Province de Liège. *Le Technologie Sanitaire*, November 1st, 1898, p. 150.

Showing the necessity for public district laboratories for examination of water supplies. Self-purification of rivers.

MALVOZ ET LAMBOTTE. Les Nappes Aquifères le long du Canal de Liège à Maestricht. *La Technologie Sanitaire*, November 1st, 1898, p. 155.

Water obtained from wells along the canal furnish good water, although the canal is almost an open sewer.

THRESH, J. C., M.D., The Protection of Urban and Rural Water Supplies. *The Journal of State Medicine*, November, 1898, p. 553.

Deals with the sources of water supplies and the means available for protecting each from pollution.

MÖRNER, CARL TH. Zur Zinkfrage. *Arch. f. Hygiene*, Bd. XXXIII., Pts. 1 & 2, 1898, p. 160.

Detection of zinc in a water supply.

COTTRELL, HENRY, E. P., ASSOC.M.INST.C.E. The Purification of Drinking Water. *Engineering*, November 11th, 1898, p. 608; continued from *Engineering*, p. 495, *ante*.

Sterilization. (To be continued.)

DAVISON, GEORGE S., M.AM.SOC.C.E. The Gas Engine Pumping Plant of the East Pittsburg Water Co. *The Engineering Record*, October 8th, 1898, p. 407.

Detailed description of plant with drawings.

HILL, WILLIAM R., M.AM.SOC.C.E. Water Distributing Systems. *The Engineering Record*, October 1st, 1898, p. 381.

Importance of systematic inspection of all apparatus and appliances. Details of construction.

MACMORRAN, ALEXANDER, Q.C. The Effect of Recent Decisions on the Liabilities and Rights of Owners in respect of the Drainage of Buildings. *The Builder*, November 12th, 1898, p. 433.

A condensed report of paper explaining the legal decisions referring to the maintenance and repair of sewers. A statutory exception is quoted showing that sewers made for profit remained private property.

HANKS, LOUIS. Failures in modern Drainage Construction with suggestions for their remedy. *Building News*, September 30th, 1898, p. 453.

Drainage guarantee by Local Authority. Materials. Testing. Jointing Pipes. Iron Pipes. Ventilation.

THOMSON, GILBERT, C.E. A suggested Standard for Drain Testing. *The Builder*, December 10th, 1898, p. 538.

Condensed report of paper advocating testing by air pressure.

DIBDIN, W. J., F.I.C., F.C.S., and THUDICHUM, G., F.C.S. Conditions necessary for the successful purification of Sewage by Bacteria. *The Surveyor*, September 23rd, 1898, p. 395.

History of bacterial processes. General conditions. Air supply. Temperature. Admission of light. Reaction to test paper of the sewage purified. Time of contact. Nature of bed material. Depth of bed.

RIDEAL, S. Standards of Purity for Sewage Effluents. *Engineering*, October 28th, 1898, p. 550. (Abstract.)

Usual purity standards for sewage arbitrary and artificial. The author's formula.

BROWN, WILLIAM. Sewage Disposal at Staines. *The Public Health Engineer*, December 17th, 1898, p. 489.

Description and Plans of Works.

Heating, Lighting, and Ventilating.

HENMAN, WILLIAM, F.R.I.B.A. A Review of a Report on the Ventilation and Warming of certain of the Metropolitan Poor Law Schools, by Wm. Napier Shaw, M.A., F.R.S. *Journal of the Royal Institute of British Architects*, November 12th, 1898, p. 12.

The Reviewer considers the buildings were very thoroughly examined, and that many valuable suggestions were made in the Report. He welcomes an official advocate of ventilation by mechanical means, and criticises adversely some of the details referred to in the Report.

WOODBRIDGE, Professor S. H. School House Warming and Ventilation. *The Engineering Record*, October 22nd and 29th, 1898, pp. 454 and 476.

Means of reducing draughts. Diffusers. Air supply for schoolrooms. Cost of building. Cost of special equipment. Boiler power necessary. Cost of moving air. Gravity ventilation.

Mechanical ventilation. Cost. Fuel for air warming. Attendance. Successive ventilation. Supply of air for rooms not frequently occupied. Course of the air supply. (*To be continued*).

OBERDIECK, Dr. CARL. Ueber Beleuchtung mit Petroleum. *Arch. f. Hygiene*, Bd. XXXIII., Pt. 3, 1898, p. 229.

On lighting with petroleum.

Personal and Domestic Hygiene.

LASCHTSCHENKO, Dr. P. Ueber Producte aus sogen. Waldwolle. *Arch. f. Hygiene*, Bd. XXXIII., Pt. 3, 1898, p. 193.

Experimental investigations of " pine wool," &c.

CHAPMAN, ALFRED C., F.I.C. A Curious Meat-Preservative. *The Analyst*, December, 1898, p. 309.

A solution intended for the preservation of Meat was found to contain: alum, sodium chloride and nitrate, sulphurous acid, benzoic acid, and chloral hydrate.

HIEROCLÈS, Dr. CONSTANTIN X. Ueber die Verwendbarkeit von Oel zur Fleischconservirung. *Arch. f. Hygiene*, Bd. XXXIII., Pts. 1 & 2, 1898, p. 155.

Employment of oil for the preservation of flesh.

DELÉPINE, Prof. SHERIDAN. Some Experiments on the Disinfection of Rooms by Gaseous Formic Aldehyde. *The Journal of State Medicine*, November, 1898, p. 527.

Details experiments made with the Formogène-Richard lamp, and points out the advantages which formic aldehyde possesses over other gaseous disinfectants.

KANTHACK, Prof. A. A., M.A., M.D. The use of Formalin Lamps for the Disinfection of Rooms. *The Lancet*, October 22nd, 1898, p. 1049.

Gives an account of a series of experiments, showing (1) that formalin, if produced in an efficient manner, is a good *superficial* disinfectant; (2) that the Alformant B lamp is untrustworthy except as a deodorizer; (3) that the Alformant A lamp is not much more trustworthy; and (4) that the Formogène-Richard lamp gives much more favourable results.

SERAFINI, Prof. Dr. A. Beitrag zum Experimentellen Studium der Desinfectionsfähigkeit gewöhnlicher Waschseifen. *Arch. f. Hygiene*, Bd. XXXIII., Pt. 4, 1898, p. 369.

Report on the Experimental Study of the disinfection value of ordinary washing soaps.

NOTES ON BOOKS AND PAPERS IN TRANSACTIONS.

"A Report on the Examination of the Water supplied to the Parish of Chelsea during the year ending November, 1898," has recently been issued by Dr. Louis C. Parkes, Medical Officer of Health for the Parish, and Dr. S. Rideal.

The physical character of the water was noted daily, and a weekly bacterioscopic examination was undertaken. The annual range of temperature was found to lie between 40° and 70° F., a fact which contrasts very unfavourably with the almost constant temperature of the water derived from deep wells. The Report mainly deals with the bacterioscopic examination, and it contains some interesting remarks and information concerning the organisms which were found to develop at blood-heat by the Parietti method. Some observations are also made by Drs. Parkes and Rideal upon the suitability of the Thames as a source of supply for London, and the Report shows some good grounds for concluding that reliance cannot be placed upon sand filtration alone, when the water is derived from a river which drains a highly cultivated and populated area.

H. R. K.

"A Simple Method of Water Analysis," by J. C. Thresh, M.D. Second Edition. 56 pp., small octavo. *J. & A. Churchill.* London, 1898.

The Author states that this book has been specially designed for the use of Medical Officers of Health, and several alterations and additions have been made to the present Edition. A section has been added specially dealing with the subject of Examination of sewage effluents, for those who desire to make systematical Examinations for comparison.

SUB.-ED.

MEETINGS HELD OCTOBER TO DECEMBER, 1898.

SESSIONAL MEETINGS.

A Meeting was held on December 14th, when a discussion was opened by E. F. Willoughby, M.D.Lond., D.P.H.Lond., on "Some Prevalent Fallacies in Vital Statistics." Prof. W. H. Corfield, M.A., M.D., in the Chair. The paper and discussion will be printed in Part I., Vol. XX. of the Journal.

LECTURES AND DEMONSTRATIONS TO SANITARY OFFICERS.

The Twenty-Sixth Course of Lectures and Practical Demonstrations and Visits of Inspections to Trade Premises and Refuse Disposal Works commenced on October 17th. 54 Students entered their names for this Course.

EXAMINATIONS.

At an Examination for Inspectors of Nuisances held at Newcastle-upon-Tyne, on November 11th and 12th, 1898, 36 Candidates presented themselves.

The following 24 Candidates were certified, as regards their Sanitary Knowledge, competent to discharge the duties of Inspectors of Nuisances:—

1898, Nov. 12. ABRAMS, JOHN EDWARD, 14, Holborn Mount, Hull.
1898, Nov. 12. AGAR, THOMAS WALLACE, 18, Derwent Street, West Hartlepool.
1898, Nov. 12. BERRY, FRED, 8, Albert Terrace, Craven Street, Oldham.
1898, Nov. 12. BROWN, GEORGE BELL, Brook Terrace, Birtley.
1898, Nov. 12. BROWN, ROBERT, Winston, Darlington.
1898, Nov. 12. CAMPBELL, JOHN, 33, Hugh Street, Wallsend.
1898, Nov. 12. DAVISON, JOHN, 3, Hotspur Place, Alnwick, Northumberland.
1898, Nov. 12. DONKIN, GEORGE GRAHAM, 51, Frederick Street, Sunderland.
1898, Nov. 12. GORTON, JOHN THOMAS, 35, North Street, Murton Colliery.
1898, Nov. 12. GRAHAM, GEORGE WILLIAM, 16, Clyde Terrace, Spennymoor, Durham.
1898, Nov. 12. HALL, FREDERICK WILLIAM, Success, Fence Houses.
1898, Nov. 12. HUNTLEY, ROBERT JOSEPH, 54, Athol Road, Sunderland.

1898, Nov. 12. Jameson, Edward Hancock, 35, Julian Street, South Shields.
1898, Nov. 12. Mullany, Michael, Bank, Barnard Castle.
1898, Nov. 12. Newell, Thomas, Post Office, Ryhope.
1898, Nov. 12. Parker, Nicholas, 103, Edgeware Road, Newcastle-upon-Tyne.
1898, Nov. 12. Plews, William Roland, 49, King Street, North Shields.
1898, Nov. 12. Pover, Harry, 54, Park Road, Faversham, Kent.
1898, Nov. 12. Smith, George, 10, Arthur Street, Darlington.
1898, Nov. 12. Snowdon, John Viney, 16, Westward Street, Middlesborough, Yorks.
1898, Nov. 12. Spetch, Frank, 2, Brighton Grove, Back Lane, Bramley, Leeds.
1898, Nov. 12. White, Thomas, 77, Ward Street, Sunderland.
1898, Nov. 12. Wright, William George, 4, Rutland Street, Werneth, Oldham.
1898, Nov. 12. *L* Wynne, Miss Annie, 16, Albert Street, Nelson, Lancashire.

Examination Questions.

Inspector of Nuisances.—Newcastle-upon-Tyne, November 11th and 12th, 1898.

1. What is the difference between a disinfectant, an antiseptic, and a deodorant? Name the best means of disinfecting (*a*) dejecta; (*b*) bed linen; (*c*) mattresses; and (*d*) rooms.

2. What statutory provisions exist for preventing the use of polluted well water for drinking purposes?

3. What is the usual procedure adopted when an Inspector finds unsound meat exposed for sale?

4. What nuisances are likely to arise in the following trades:—(1) manufacture of kid gloves; (2) the storage of carbide of calcium; (3) the manufacture of illuminating gas from crude petroleum; (4) blood-boiling.

5. A nuisance arises from a foul accumulation of manure on private premises. What power of entry is given by the Public Health Acts, and how would you deal with the nuisance?

6. How would you proceed to test (*a*) new drains; (*b*) old drains?

7. Describe the various forms of stoneware and lead traps in common use. Give sketches shewing the diameters of the traps and the positions in which they should be placed.

8. How long will it take to fill a cistern 5-ft. × 4-ft. × 3-ft. 6-in. through a pipe 1-in. diameter, the rate of flow being three feet per second?

The Candidates were examined vivâ voce *on the* 12*th.*

At an Examination in Practical Sanitary Science, held in London, on December 2nd and 3rd, 1898, 6 Candidates presented themselves.

The following Candidate was granted a Certificate in Practical Sanitary Science:—

1898, Dec. 3. Orr, William, 17, Cambridge Gardens, Hanwell.

At an Examination for Inspectors of Nuisances, held in London, on December 2nd and 3rd, 1898, 128 Candidates presented themselves.

The following 74 Candidates were certified, as regards their Sanitary knowledge, competent to discharge the duties of Inspectors of Nuisances:—

1898, Dec. 3. Alflatt, Charles Drake, 27, North Everard St., King's Lynn.
1898, Dec. 3. Allpress, Sidney, Broughton, Huntingdon.
1898, Dec. 3. Blackler, Stanley Samuel, Totness House, St. Margaret's Terrace, Plumstead Common, S.E.
1898, Dec. 3. Bolton, Joseph Hook Percival, Chase Side, Southgate, N.
1898, Dec. 3. Boyland, William, 154, Emsworth Road, North End, Landport.
1898, Dec. 3. Bull, Edward, 84, Trinity St., Canning Town, E.
1898, Dec. 3. *L* Burton, Miss Ethel Frances, Eversley, Estre Road, Blundellsands, Liverpool.
1898, Dec. 3. Burr, William Walker, 430, Grosvenor Buildings, Manisty Street, Poplar, E.
1898, Dec. 3. Carter, George Edwin, 5, Richmond Terrace, Bedminster, Bristol.
1898, Dec. 3. Carwithen, Ernest, 4, Carlton Terrace, Plymouth.
1898, Dec. 3. Cashmore, Ralph Henry, 34, Smith St., Warwick.
1898, Dec. 3. Chambers, Sidney Harry, 4, Devonshire Villas, Windmill Road, Hampton Hill, Middlesex.
1898, Dec. 3. Cockcroft, William Henry, 42, Caledon Road, East Ham, Essex.
1898, Dec. 3. Coleman, Frederick, 48, Andover Rd., Holloway, N.
1898, Dec. 3. *L* Cunynghame, Miss Anna Bertha de Mallet, 27, Glencairn Crescent, Edinburgh.
1898, Dec. 3. Dormer, Percy Charles, Raunds, Northampton.
1898, Dec. 3. Down, William Edward, 54, Kestrel Avenue, Herne Hill, S.E.
1898, Dec. 3. Drown, Robert George, 20, Adelaide Square, Windsor.
1898, Dec. 3. Edwards, Frederick George, 3a, Prah Road, Finsbury Park, N.
1898, Dec. 3. Farmer, John Edwin, Eccles Villa, Percy Road, Beddington Corner, Mitcham.
1898, Dec. 3. Fisher, George, 56, Calvert Road, Greenwich.
1898, Dec. 3. *L* Gardiner, Miss Roberta Elizabeth, 92, Auckland Road, Upper Norwood, S.E.

1898, Dec. 3. Gray, Frederick Ernest, 45, Grosvenor Park Road, Walthamstow.

1898, Dec. 3. [illegible], Hugh Lawrence, Bush Street E., Pembroke Dock.

1898, Dec. 3. [illegible], Henry Thomas, 6, Branksome Road, Acre Lane, Brixton, S.W.

1898, Dec. 3. Harvey, Francis John, 42, Abingdon Villas, Kensington, W.

1898, Dec. 3. [illegible], Henry Oswald, 32, Plough Road, Rotherhithe, S.E.

1898, Dec. 3. Harris, John Clark, 6, Hampton Place, St. Mary Church, near Torquay.

1898, Dec. 3. [illegible], Samuel, 3[illegible], High Road, South Town, Great Yarmouth.

1898, Dec. 3. [illegible], Walter, 150, Uxbridge Road, W.

1898, Dec. 3. [illegible], Robert William, Laleham, Middlesex.

1898, Dec. 3. Hitchcock, Frederick William, Arundale, Seymour Villas, Anerley, S.E.

1898, Dec. 3. [illegible], Harry, 6, Brookfield Road, Kingston, Portsmouth.

1898, Dec. 3. [illegible], Edward George, High Street, Romford, Essex.

1898, Dec. 3. L [illegible], Miss Ethel Mary, Euston Villa, Lansdowne Road, Worcester.

1898, Dec. 3. Hughes, William Arthur, 23, Egerton Road, Greenwich.

1898, Dec. 3. Hunt, William Thomas, 48, Church Road, Landport, Portsmouth.

1898, Dec. 3. Hussey, Edwin Stanley, 10, Shroton Street, Marylebone, W.

1898, Dec. 3. Jeffes, Reginald Herbert, 21, Prospect Place, Long Ditton, Surrey.

1898, Dec. 3. Jenkins, Frederick, 114, Church Road, Kingston, Portsmouth.

1898, Dec. 3. Kinch, Thomas Edwin, 94, Hollybush Street, Plaistow, E.

1898, Dec. 3. Leaf, Edwin, 24, Brecknock Road, N.

1898, Dec. 3. Littleton, Frank, 139, Latchmere Road, Shaftesbury Park, S.W.

1898, Dec. 3. Loveday, William Frederick, The Council Offices, Milton Road, South Hornsey.

1898, Dec. 3. MacDonald, Kenneth Grant, 21, Gt. George St., S.W.

1898, Dec. 3. L McCrossan, Miss Jessie Jane, 15, Kingsmead Rd., N. Oxton, Birkenhead.

1898, Dec. 3. McMeikan, Thomas, 3, Carwinion Terrace, Liskeard, Cornwall.

1898, Dec. 3. Marsh, Francis Edward, 36, Broadway, Frome, Somerset.

1898, Dec. 3. MILLER, GEORGE LONGBOTHAM, Urban District Council Offices, Whitby.
1898, Dec. 3. MILLS, ALFRED THOMAS, 100, Sewardstone Road, Victoria Park, N.E.
1898, Dec. 3. MINERS, GEORGE JOHN REYNOLDS, 39, Dee Street, Bromley, E.
1898, Dec. 3. MOORE, FRANK OWEN, 12, Cornford Grove, Balham, S.W.
1898, Dec. 3. NICHOLAS, ARTHUR, 21, Frederick St,, King's Cross.
1898, Dec. 3. OWNER, JOSHUA, 140, Forty Acre Lane, Plaistow, E.
1898, Dec. 3. PAIGE, HERBERT GEORGE, 64, Agincourt Road, Buckland, Portsmouth.
1898, Dec. 3. PEARSON, THOMAS, 1, Merritt Street, Huntingdon.
1898, Dec. 3. PEGRAM, GEORGE HENRY, West View, Epping, Essex.
1898, Dec. 3. PHILLIPS, FRANCIS EDWARD, Bryn Eirw, Hafod, Pontypridd.
1898, Dec. 3. PLEWES, ROBERT THOMAS, Rawcliffe, R.S.O.
1898, Dec. 3. RACKHAM, EDWARD, 39, London Road, Boxmoor, Herts.
1898, Dec. 3. READ, FRANK, 36, Wallwood Road, Leytonstone.
1898, Dec. 3. SANDS, PERCY BRETT, 19, Warwick Gardens, Kensington, W.
1898, Dec. 3. SHRIVES, AMOS, Hardingstone, Northampton.
1898, Dec. 3. SLAUGHTER, FREDERICK, Jarvis Villa, Steyning.
1898, Dec. 3. TAVERNER, GEORGE FRANK, 39, Haggard Road, Twickenham.
1898, Dec. 3 TAYLOR, WILLIAM, 1A, Meadow Road, Southborough, Tunbridge Wells.
1898, Dec. 3. WALKER, FREDERICK LAMBERT, 8, Gladstone Road, Watford.
1898, Dec. 3. WALKER, WILLIAM LEE, 1, Idris Villas, Towyn.
1898, Dec. 3. WEBB, CHARLES FREEMAN, 33, Willoughby Lane, Tottenham, N.
1898. Dec. 3. WHITE, SIDNEY TOM WRIGHT, Fenny Compton, near Leamington.
1898, Dec. 3. *L* WILKIN, Miss EMILY HARRIET, Tiptree, Kelvedon, Essex.
1898, Dec. 3. WILSON, FRED, 225, Nottingham Street, Sheffield.
1898, Dec. 3. WINTER, EDWARD, Junr., 82, Church Road, Hove.
1898, Dec. 3. WISEMAN, FREDERICK, 308, High Road, Leytonstone.

Examination Questions.

Practical Sanitary Science.—London, December 2nd and 3rd, 1898.

PAPER 1.

1. What is the law relating to the diffusion of gases? What bearing has this on the ventilation of living rooms?

2. Describe the wet and dry bulb thermometers. State how the relative humidity of the atmosphere can be arrived at by means of this instrument.

3. What is meant by "ground air" and "ground water"? What circumstances affect the movements of each, and how may they get polluted?

4. Specify the construction and materials of a fire-proof floor, 60-ft. long and 20-ft. wide, capable of bearing a distributed weight of 25 tons.

PAPER II.

5. How can a schoolroom best be ventilated? What should be the size of inlets and outlets provided, and what should be the relative positions of these openings?

6. Describe briefly a Refuse-Destructor and its uses. What temperature is usually maintained to destroy ordinary town refuse, and what percentage of clinker remains after cremation.

7. In what state of combination does the largest proportion of nitrogen exist in fresh town sewage? Shortly describe the treatment you would recommend for defecating the sewage, and utilising the nitrogen compounds in solution.

8. A drain with a fall of 1 in 40 has a velocity of flow of 3 feet per second; what velocity would be secured if the same drain is relaid with a fall of 1 in 30?

The Candidates were examined vivâ voce *on the 3rd.*

Inspector of Nuisances.—London, December 2nd and 3rd, 1898.

1. Describe briefly how to lay domestic drains from house to sewer. Give plan to scale of 8-ft. to 1-in., and state diameters and fall to sewer.

2. In a case of typhoid fever occurring in a crowded tenement dwelling, describe in detail what steps you would take to prevent the spread of the disease with respect to the following points:—

(*a*) The sick;
(*b*) The healthy members of the family;
(*c*) The bedding, clothing, and other articles exposed to infection;
(*d*) The rooms;
(*e*) The drainage.

3. Give a list of the offensive cargoes most frequently carried by canal boats, and state the precautions that should be taken to prevent nuisance. What are the chief regulations as to cargoes made by the Local Government Board under the Canal Boats Acts?

4. Define "hard" and "soft" water. State the action of the latter on lead, and how such action may be prevented.

5. Describe the appearance of measly pork, and the effects when eaten by men.

6. What are the cubical contents of a circular rain water tank, 11-ft. diameter and 12-ft. deep, with a flat bottom? State the weight of the water that it would contain.

7. What are the provisions of the Sale of Food and Drugs Acts with regard to the purchase of samples for analysis?

8. Sketch a good form of slop-sink for domestic use, and shew the method of connecting the waste from the slop sink situated on the first floor to the drain.

The Candidates were examined vivâ voce *on the 3rd.*

At an Examination in Practical Sanitary Science, held at Manchester, on December 16th and 17th, 1898, 6 Canditates presented themselves.

The following Candidate was granted a Certificate in Practical Sanitary Science:—

1898, Dec. 17. BALL, WILLIAM JOHN, 17, Wellfield St., Warrington.

At an Examination for Inspectors of Nuisances, held at Manchester, on December 16th and 17th, 121 Candidates presented themselves.

The following 56 Candidates were certified, as regards their Sanitary Knowledge, competent to discharge the duties of Inspectors of Nuisances:—

1898, Dec. 17. ALEXANDER, GEORGE, 12, James Place, Leith, N.B.
1898, Dec. 17. ARUNDALE, PERCY, 40, North Street, Longsight, Manchester.
1898, Dec. 17. BALL, HENRY HARWARD, 15, Cathedral Road, Liverpool.
1898, Dec. 17. BEATTIE, JAMES, 46, Walton Brick Road, Liverpool.
1898, Dec. 17, BILLINGHAME, ALBERT HENRY, 3, Wycliffe Street, Rock Ferry, Birkenhead.
1898, Dec. 17. BROWN, JOSEPH, Alneburgh House, Maryport.
1898, Dec. 17. CAINE, WILLIAM, 19, Ainslie Street, Dalton-in-Furness.
1898, Dec. 17. CARTER, JOSEPH H., Burnley.
1898, Dec. 17. CLARK, DAVID SIDDALL, 1, Piccadilly St., Haslingden.
1898, Dec. 17. COFFEY, HENRY, 17, Blackburn Grove, Bootle.
1898, Dec. 17. CUDWORTH, FRANK, Guildhall, Wrexham, N. Wales.
1898, Dec. 17. CUMMINGS, JOSEPH, 5, Chapel Street, Dalton-in-Furness.
1898, Dec. 17. DAVIS, JOHN HENRY, 1, Whitestone Road, Fartown, Huddersfield.
1898, Dec. 17. DAWSON, SAMUEL, 23, Queen's Road, Chadderton, Oldham.

98, Dec. 17. Dowson, Matthew, Harwood, [illegible]-dale.
98, Dec. 17. Duckworth, John, 43, St. Paul's Road, Birkenhead.
98, Dec. 17. Everington, Frank, 75a, Milnrow Road, Shaw, near Oldham.
1898, Dec. 17. Garnham, Alfred Joseph, 11, Princess Terrace, Oxton, Birkenhead.
1898, Dec. 17. Hanson, Frederick, 2, Atlas Street, Bradford.
1898, Dec. 17. Haworth, John, 40, Tanners Street, Ramsbottom.
1898, Dec. 17. Hellon, John, 75, Bamber Street, Liverpool.
1898, Dec. 17. Henderson, Joseph, Ponteland, near Newcastle-on-Tyne.
1898, Dec. 17. Hey, Benjamin, 184, Ingrow Lane, Keighley.
1898, Dec. 17. Hindmarch, John Leighton, Tindale Crescent, Bishop Auckland.
1898, Dec. 17. Hope, Clement, 13, Braithwaite Street, Blackpool.
1898, Dec. 17. *L* Howie, Miss Margaret, Joel View, Beech Road, Chorlton-cum-Hardy, Manchester.
1898, Dec. 17. Jackson, Fred, 24, Cambridge Street, Werneth, Oldham.
1898, Dec. 17. Jaques, Ernest, 109, Durnford Street, Middleton.
1898, Dec. 17. Johnson, Frederick Thomas, 17, Queen's Court, Ulveston, Lanc.
1898, Dec. 17. Jones, Harry Thomas, Holly House, Clydach, R.S.O., Glamorganshire.
1898, Dec. 17. Kershaw, Mark, 133, Duke Street, Brooks Bar, Manchester.
1898, Dec. 17. Lawton, Charles Henry, 105, Church Street, Silverdale, N. Staffs.
1898, Dec. 17. Leversley, George William, Town Hall, Dewsbury.
1898, Dec. 17. Lord, William, 16, Hampson Street, Belfield, Rochdale.
1898, Dec. 17. Mason, George William, 47, Meadow Street, New Brighton, Cheshire.
1898, Dec. 17. Noble, William, 5, Albert Street, Chester Road, Macclesfield.
1898, Dec. 17. Parker, Richard, 97, Earl Street, Bradford.
1898, Dec. 17. Perry, William Albert, 296, Eccles New Road, Salford.
1898, Dec. 17. Pickstone, Mark, 14, Park Street, Radcliffe, Manchester.
1898, Dec. 17. Potter, James, 6, Elmsley Street, Bingley, Yorks.
1898, Dec. 17. Robinson, Tom, 12, Primrose Street, Nelson, Lancs.
1898, Dec. 17. Ross, James, 89, Greengate, Salford.
1898, Dec. 17. Severn, Charles, 6, Albert Street, Hucknall, Torkard, Notts.
1898, Dec. 17. *L* Sharples, Miss Margaret Louisa, Springfield, Little Sutton, Chester.
1898, Dec. 17. Souter, William, 296, Oldham Road, Failsworth.

1898, Dec. 17. SOUTHWART, JOSEPH, 4, Richmond Terrace, Matlock Bridge, Derbyshire.
1898, Dec. 17. STANDRING, WILLIAM, 20, Mount Terrace, Rawtenstall.
1898, Dec. 17. STOCKS, GEORGE, Church Fields, Brighouse.
1898, Dec. 17. TAYLOR, JAMES B., 41, De Grey Street, Hull.
1898, Dec. 17. TAYLOR, WILLIAM, 49, Moorhey Street, Lees Road, Oldham.
1898, Dec. 17. TRUEMAN, JAMES, Bollington.
1898, Dec. 17. WAGSTAFFE, WILLIAM JOSEPH, Holmes Chapel, near Crewe.
1898, Dec. 17. WATSON, ARTHUR, 109, Trafalgar Street, Sheffield.
1898, Dec. 17. WATSON, JOHN GEORGE, 112, Weelsby Street, Grimsby.
1898, Dec. 17. WILKINSON, PERCY GEORGE, Rossiter Rd., Greasbro', near Rotherham.
1898, Dec. 17. YOUNG, WILLIAM PERCY, Rushall, near Walsall.

Examination Questions.

Practical Sanitary Science.—Manchester, December 16th and 17th, 1898.

PAPER I.

1. Describe the action of the so-called lift and force pump. From what depth is it theoretically possible—with the barometer standing at thirty inches—to raise water with a simple lift pump?

2. What is the average usual rainfall in the North, South, East, and West of England respectively? What are the chief geographical conditions modifying the rainfall?

3. How would you define hardness of water? Describe in detail a method suitable for softening water for a general public supply.

4. What methods have been proposed for the treatment of sewage? Upon what principles do they depend? Describe any one method in detail.

PAPER II.

5. Contrast the advantages and disadvantages of open fireplaces, and warming by hot air, hot water, and steam.

6. What is the best position for a fresh-air inlet to enter a disconnection chamber as regards the disconnecting trap? Illustrate by sketch and give the size of air inlet in relation to the sectional area of the upcast shafts of the drains.

7. What is meant by an infectious disease? Give two examples and detail the chief precautions to be taken when an infective fever occurs in a house.

8. What weight of water would be discharged per second through a circular orifice of one-inch diameter, under a pressure of 1000 lbs. per square foot neglecting friction?

The Candidates were examined vivâ voce *on the 17th.*

FORTHCOMING MEETINGS.

CALENDAR, JANUARY TO APRIL, 1899.

As far as at present arranged.

Council Meetings are held Monthly on the Second Wednesday in each Month at 5 p.m., except August and September.

Special Purposes Committee	Third Monday at 5 p.m.
Finance Committee	Second Wednesday at 4.30 p.m.
Exhibition Committee	First Monday at 5 p.m.*
Congress and Editing Committee	Second Monday at 5 p.m.
Museum and Library Committee	Fourth Monday at 5 p.m.
Parliamentary Committee	As occasion requires.
Rivers Pollution Committee	As occasion requires.

FEBRUARY.

8 W. **Sessional Meeting at 8 p.m.**
10 F. } Examination in Practical Sanitary Science and Inspectors of Nui-
11 S. } sances, Bristol.
20 M. Introductory Lecture to 27th Course of Lectures and Demonstrations and Inspections for Sanitary Officers (Admission Free), by Prof. W. H. Corfield, M.A., M.D.(OXON.), F.R.C.P.(LOND.).
23 Th. Lecture to Sanitary Officers at 8 p.m. Sanitary Law—English, Scotch, and Irish; General Enactments Public Health Act, 1875; Model By-Laws, &c., by Herbert Manley, M.A. (CANTAB), M.B. D.P.H., Medical Officer of Health, West Bromwich.
25 S. Inspectation and Demonstration at the Aylesbury Dairy Company's Premises, Bayswater, at 3 p.m. (number limited).
27 M. Lecture to Sanitary Officers at 8 p.m. The Law Relating to the Supervision of Food Supply, by

MARCH.

1 W. Inspection and Demonstration in the Parish of St. George, Hanover Square, at 2 p.m. (limited), conducted by Albert Taylor, Chief Sanitary Inspector.
2 Th. Lecture to Sanitary Officers at 8 p.m. Trade Nuisances, by Prof. A. Bostock Hill, M.D., D.P.H.(CAMB.), F.I.C., Queen's Professor of Hygiene and Public Health, Mason's University College, Birmingham, Medical Officer of Health, Sutton-Coldfield, &c.
4 S. Inspection and Demonstration.
6 M. Lecture to Sanitary Officers at 8 p.m. Diseases of Animals in relation to Meat Supply; Characteristics of Vegetables, Fish, &c., unfit for food, by Alfred Hill, M.D., F.R.S.E., F.I.C., Medical Officer of Health, Birmingham.
8 W. **Sessional Meeting at 8 p.m.**
8 W. Inspection and Demonstration.
9 T. Lecture to Sanitary Officers at 8 p.m. Objects and Methods of Inspection, Nuisances, &c., by J. F. J. Sykes, D.SC., M.D., Lecturer on Public Health, Guy's Hospital, Med. Officer of Health, St. Pancras.
10 F. } Examination in Practical Sanitary Science and Inspectors of Nui-
11 S. } sances, Glasgow.
11 S. Inspection and Demonstration.
13 M. Lecture to Sanitary Officers at 8 p.m. Ventilation, Warming, and Lighting, by Joseph Priestley, B.A., M.D., M.R.C.S., D.P.H.(CAMB.), Medical Officer of Health, Lambeth.

* Except April.

15 W. Inspection and Demonstration.

16 M. Lecture to Sanitary Officers at 8 p.m. Infectious Diseases and Methods of Disinfection, by Henry R. Kenwood, M.B., D.P.H., F.C.S., Medical Officer of Health, Stoke Newington.

18 S. Inspection and Demonstration.

20 Th. Lecture to Sanitary Officers at 8 p.m. Water Supply, Drinking Water, Pollution of Water, by Louis C. Parkes, M.D., D.P.H., Medical Officer of Health, Chelsea.

22 W. Inspection and Demonstration at the East London Waterworks, Lee Bridge, at 3 p.m., conducted by the Engineer, W. B. Bryan, M.Inst.C.E.

22 W. **Ordinary General Meeting at 5 p.m.**

23 Th. Demonstration of Diseased Meat in the Parkes Museum, at 8 p.m., by W. A. Bond, M.A., M.D., D.P.H., Medical Officer of Health, Holborn, and St. Olave's, Southwark.

25 S. Inspection and Demonstration at Sutton Sewage Works, at 3 p.m., conducted by C. C. Smith, Town Surveyor.

27 M. Inspection and Demonstration at the Metropolitan Cattle Market, York Road, N., at 3 p.m.

29 W. Demonstration of Book-keeping as carried out in a Sanitary Inspector's Office, in the Parkes Museum at 8 p.m., by Albert Taylor, Chief Sanitary Inspector, St. George's, Hanover Square.

APRIL.

3 M. *Easter Monday.*

10 M. Lecture to Sanitary Officers at 8 p.m. Sanitary Building Construction, by Edwin T. Hall, F.R.I.B.A.

12 W. **Sessional Meeting at 8 p.m.** Discussion on Practical Hygiene Teaching in Elementary Schools, to be opened by Miss Alice Ravenhill.

12 W. Inspection and Demonstration at Chelsea Disinfecting Station, at 3 p.m., conducted by Dr. Louis Parkes.

13 Th. Lecture to Sanitary Officers at 8 p.m. House Drainage, by W. C. Tyndale, M.INST.C.E.

14 F. } Examinations in Practical Sanitary Science and for Inspectors of
15 S. } Nuisances, Birmingham.

15 S. Inspection and Demonstration at the Beddington Sewage Farm, at about 3 p.m., conducted by the Engineer and Surveyor, Thomas Walker, M.Inst.C.E.

17 M. Lecture to Sanitary Officers at 8 p.m. Sanitary Appliances, by G. Reid, M.D., D.P.H., Medical Officer of Health, Staffordshire County Council.

19 W. Inspection and Demonstration in the Parish of St. George, Hanover Square, at 2 p.m. (limited), conducted by Albert Taylor, Chief Sanitary Inspector.

20 Th. Lecture to Sanitary Officers at 8 p.m. Details of Plumbers' Work, by J. Wright Clarke.

22 S. Inspection and Demonstration at the Ealing Electric Light Station, Refuse Destructor, Sewage Works, &c., at 2.15 p.m., conducted by the Engineer and Surveyor, Charles Jones, M.Inst.C.E.

24 M. Lecture to Sanitary Officers at 8 p.m. Sewerage and Sewage Disposal, by Prof. Henry Robinson, M.INST.C.E.

27 Th. Lecture to Sanitary Officers at 8 p.m. Scavenging, Disposal of House Refuse, by Charles Jones, M.INST.C.E., Engineer and Surveyor, Ealing Urban District Council.

29 S. Inspection and Demonstration at Barking Sewage Outfall Works, at 3 p.m., conducted by the District Engineer, L.C.C., John Ed. Worth, M.Inst.C.E.

Complete List of Lectures and Demonstrations can be obtained at the Institute.

)NORARY FELLOWS, MEMBERS, AND ASSOCIATES ELECTED.

From October to December, 1898, inclusive.

(A complete list can be had on application.)

HONORARY FELLOWS.

39 1898. Nov. Celli Angelo, *Instituto d Igiene Sperimentale, Rome.*

40 1898. Nov. Janssens Eugene, 21, *Rue du Lombard, Brussels.*

M ERS.

† Passed Ex or Local Surveyor.

* Passed the Examination tute in Practical Sanitary Science.

‡ Passed Exami nspector of Nuisances.

Reg. No. Date of Election.

1219 1898. Nov. Ackermann, phus William, assoc.m.inst.c.e., *Castle C Buildings, Adderley St., Cape Town, C y.*

1220 1898. Nov. †‡Adams, A rard, *Chippenham, Wiltshire.*

1214 1898. Oct. Atkinson, , *Kiveton Park, Yorks.*

1221 1898. Nov. Bell, An Valker, assoc.m.inst.c.e., f.s.i., *Burgh C Dunfermline.*

1240 1898. Dec. *‡Bellamy, E., *Municipal Buildings, Truro.*

1241 1898. Dec. Bentley, enry, assoc.m.inst.c.e., 31, *Fern Street, Oldham.*

1222 1898. Nov. Bowe, Daniel Jackson, *Borough Engineer's Office, Town Hall, Eastbourne.*

1215 1898. Oct. Braga, John Francis, d.p.h.lond., f.c.s., f.l.s., f.g.s., 1, *Albert Villas, High Road, Chiswick.*

1223 1898. Nov. Callen, Thomas, assoc.m.inst.c.e., *Kimberley.*

1224 1898. Nov. *‡Chadwick, John, *Bletchley, Bucks.*

1225 1898. Nov. Davies, Sidney, m.a., m.d.oxon., d.p.h.camb., m.o.h., *Plumstead, S.E.*

1226 1898. Nov. Dunn, George Owen William, m.inst.c.e. *(of Bombay P.W.D.), c/o Messrs. Grindlay, 54, Parliament Street, S.W.*

1227 1898. Nov. *‡Fleming. Richard Philip, *Dundee, Forfar, N.B.*

1216 1898. Oct. *Gailey, Thomas A., b.e., b.a., 324, *Woodstock Road, Belfast.*

1217 1898. Oct. Gray, R. Bruce MacGregor, assoc.m.inst.c.e., *Town* Surveyor and Sanitary Inspector, *Town Hall, Selby.*

Reg. No.	Date of Election.	
1242	1898. Dec.	HANDFORD, Henry, M.D., M.R.C.P., D.P.H., M.O.H., *Notts. C.C.*, 6, *Regent Street, Nottingham.*
1228	1898. Nov.	‡HORSFIELD, Jonathan Pachett, *Fort Salisbury, Rhodesia.*
1218	1898. Oct.	HUMPHREYS, Henry Howard, ASSOC.M.INST.C.E., 6, *Stanley Gardens, Willesden Green.*
1229	1898. Nov.	IVY, Richard Carruthers, ASSOC.M.INST.C.E., *Burslough St., Ormskirk.*
1230	1898. Nov.	LAWSON, Charles Griffin, ASSOC.M.INST.C.E., *Palmer's Green, N.*
1243	1898. Dec.	MOLINEUX, W. F. Y,, *Winchester, Southampton.*
1244	1898. Dec.	NIVEN, James, M.A., M.B., M.O.H., *Health Department, Town Hall, Manchester.*
1245	1898. Dec.	PAKES, Walter Charles Cross, L.R.C.P., M.R.C.S., D.P.H., F.C.S., 14, *Trinity Square, S.E.*
1231	1898. Nov.	PHILLIPS, Robert, ASSOC.M.INST.C.E., 9, *Belgrave Road, Gloucester.*
1232	1898. Nov.	READ, Maybyn, B.A., M.D., D.P.H., M.R.C.S., M.O.H., 42, *Foregate Street, Worcester.*
1233	1898. Nov.	RICHMOND, James, M.B., D.P.H., M.O.H., 133, *Soho. Hill, Handsworth, Birmingham.*
1234	1898. Nov.	RIGBY, Herbert Peter Barrow, ASSOC.M.INST.C.E., *Cape Town.*
1235	1898. Nov.	SHARP, Frederick, M.INST.C.E., "*Helidon,*" *Branksome Park, Bournemouth.*
1236	1898. Nov.	WALKER, Herbert, F.R.I.B.A., ASSOC.M.INST.C.E., *Newcastle Chambers, Nottingham.*
1246	1898. Dec.	WHITWORTH, William, *Codsall, Cradley Heath.*
1237	1898. Nov.	WILSON, C. L. N., ASSOC.M.INST.C.E., *Bangor Villa, Bilston.*
1247	1898. Dec.	WOODHEAD, German Sims, M.D., F.R.C.P., F.R.S.EDIN., 1, *Nightingale Lane, Balham, S.W.*
1238	1898. Nov.	YABBICOM, Thomas Henry, ASSOC.M.INST.C.E., 63, *Queen Square, Bristol.*
1239	1898. Nov.	YARROW, George Eugene, M.D., M.O.H., D.P.H., 26, *Duncan Terrace, Islington, N.*

ASSOCIATES.

Passed Examination for Inspector of Nuisances.

Reg. No.	Date of Election.	
1795	1898. Oct.	‡AINLEY, Edwin, *Lower Park, Berry Brow, Huddersfield.*
1815	1898. Nov.	‡ALLAN, John, 78, *Holmscroft Street, Greenock.*
1796	1898. Oct.	‡ALLEN, Arthur Taylor, 1, *St. Andrew's Road, Portslade-by-Sea.*
1810	1898. Nov.	‡ASQUITH, Arthur, 7, *Bailey Street, Tonpentre R. S. O.*

Reg. No. Date of Election.

1841 1898. Dec. ‡Ball, James Maxwell, 15, *Dale View, Buxton.*
1842 1898. Dec. ‡Bickford, Walter Felthouse, 10, *Alfred Street, Plymouth.*
1817 1898. Nov. ‡Biker, Tom, *Barnoldswick, Yorks.*
1818 1898. Nov. ‡Bishop, Ernest George, 24, *Gibbon Street, Plymouth.*
1819 1898. Nov. ‡Brocklehurst, Josephus Higginbottom, 117, *Old Lane, Chadderton, Hollinwood, Oldham.*
1820 1898. Nov. ‡Burnard, Isaiah, 4, *Littleton Place, Stoke, Devonport.*
1797 1898. Oct. ‡Burrell, Tom Leonard, 24, *Lordship Lane, Wood Green, N.*
1821 1898. Nov. ‡Callow, Henry, *Ferndale*, 23, *Arodene Road, Brixton Hill.*
1822 1898. Nov. ‡Cheetham, Augustus Ernest, *Church Road, Urmston, Manchester.*
1798 1898. Oct. ‡Cordner, Miss Edith Helena, 6, *St. Oswald's Road, West Brompton.*
1799 1898. Oct. ‡Coupe, James, 4, *New Brighton, Bramley, Leeds.*
1823 1898. Nov. ‡Crossland, James, *South Langrigge, Bowness-on-Windermere.*
1824 1898. Nov. ‡Daft, John James, 9, *Clyde Street, Wilford Road, Nottingham.*
1800 1898. Oct. ‡Dalzell, Arthur George, 15, *Commercial Street, Halifax.*
1801 1898. Oct. ‡Davis, George Edward James, 4, *Lupus Street, St. George's Square, S.W.*
1843 1898. Dec. ‡Davy, Samuel Nicholas, *The Coroner's Court, Cambridge Street, St. Pancras, N.W.*
1825 1898. Nov. ‡Dunlop, Andrew, 2, *Chester Villas, Wellbrook Road, Farnboro' R.S.O.*
1802 1898. Oct. ‡Few, Edwin, 17, *Highbury Park, Highbury, N.*
1803 1898. Oct. ‡Girven, Frederick William, *Pemberton Bank, Easington Lane, R.S.O.*
1826 1898. Nov. ‡Green, John Thomas, 42, *Corporation Steet, Walsall.*
1804 1898. Oct. ‡Hardy, Herbert R., *Health Department, Municipal Buildings, Norwich.*
1827 1898. Nov. ‡Harrison, James William, *Oak Cottage, Keighley.*
1805 1898. Oct. ‡Jackson, Joseph, 33, *Sandgate, Penrith.*
1828 1898. Nov. ‡Jones, John W., *Belgrave Cwmbwrla, Swansea.*
1829 1898. Nov. ‡Kinch, Maurice Whinley, 3, *Walnut Villas, Cockington, Torquay.*
1830 1898. Nov. ‡Kirkby, Reginald Guy, 1, *Cairo Street, Sunderland.*
1831 1898. Nov. ‡Leigh, Arthur Graham, *Chorcliff House, Chorley.*
1832 1898. Nov. ‡Marshall, James, *Stevenson Street, Little Hulton, Bolton.*
1806 1898. Oct. ‡Merryman, Augustus Henry, 84, *Bridge Street, Castleford.*
1833 1898. Nov. ‡Moore, John, 10, *Duke St., South Shore, Blackpool.*

Reg. No.	Date of Election.	
1844	1898. Dec.	‡Owen, William, *Menai View, Llandegfan, near Menai Bridge.*
1807	1898. Oct.	‡Pooley, Arthur Henry, 12, *Charing Cross, Norwich.*
1808	1898. Oct.	‡Portman, William Charles, 46, *Bolina Road, Cliftonville, Kent.*
1809	1898. Oct.	‡Sayers, Andrew, 187, *Grosvenor Road, Belfast.*
1834	1898. Nov.	‡Scott, George, Junr., *Daisy Hill, via Chester-le-Street.*
1835	1898. Nov.	‡Sheldon, William, *Town Hall, Workington.*
1810	1898. Oct.	‡Siddall, George, *Ossett Spa, Ossett.*
1836	1898. Nov.	‡Silcox, Henry George William, 5, *Fountain Buildings, Bath.*
1837	1898. Nov.	‡Smith, Arthur, 12, *Jubilee Grove, Seacombe.*
1838	1891. Nov.	‡Stone, James Arthur, 38, *Church Road, Weston-super-Mare.*
1811	1898. Oct.	‡Townshend, Mrs. Emily C., 26, *Buckingham Mansions, S.W.*
1839	1898. Nov.	‡Walker, John, *Fellside School, Kendal.*
1812	1898. Oct.	‡Walker, John Daniel, 66, *Devonport Road, Shepherd's Bush.*
1813	1898. Oct.	‡Weeks, George Robert, 213, *Clapham Road, S.W.*
1814	1898. Oct.	‡West, James, 142, *Lillie Road, Fulham, S.W.*
1840	1898. Nov.	‡Winterbottom, George, 57, *Cobden Street, Waterhead, Oldham.*

OBITUARY.

COLONEL GEORGE E. WARING, Junr., M.Inst.CE.

(Fellow.)

All who have been interested in the progress of sanitary science in recent years abroad, as well as in this country, have doubtless learned before these paragraphs reach them of the death on October 26th of Colonel George E. Waring, Junr., from yellow fever contracted while in Havana.

While to some this manner of his death may appear tragic, it is probable that Colonel Waring would have asked nothing better than to pass away, when the appointed time came, while in the discharge of duties to which he had been assigned as an expert sanitarian by the President of the United States.

One of his strongest claims to a permanent place in the history of engineering is that he woke popular appreciation of the importance of sanitary science.

His first conspicuous achievement was connected with the

Memphis yellow fever epidemic, when as a member of a national commission with Dr. John S. Hellays, U.S.A., and Dr. Folsom of Massachusetts, he first introduced the separate system of sewerage into the United States.

Memphis at that time had little money, and the fever had scourged it so severely that it was proposed to abandon the site entirely.

It was mainly Colonel Waring who cheered up the desponding citizens, and showed them how they could build a system of sewers to carry away the house drainage, only at a cost far below that of the combined system then in use in large cities.

He also introduced the sub-surface irrigation system of sewage disposal, which Rogers Field made practicable by the invention of the flush tank. Colonel Waring used it first at Lenox in a small way, and hence it became popularly known by his name. Since that time it has proved of much value in disposing of the sewage of isolated buildings under suitable conditions.

Aside from his services in the field of sanitary engineering, he will probably be longest known as the organiser of a street cleaning department, which really kept New York clean, and has become a model for similar bureaus elsewhere. His success was so remarkable that his fame is now doubtless world wide.

The "Engineering Record" of New York, from which the foregoing lines are extracted, remarks that Colonel Waring's latest work entitles him to national recognition.

George E. Waring was born at Poundridge, Westchester County, in 1833. He was a son of George E. Waring, a wealthy stove founder of Stamford, Conn. In the Civil War he commanded the Fourth Cavalry of Missouri.

Other important works in sanitary engineering carried out were the construction of a sewer system in Ogdensburg, in 1871; the main sewer of Saratoga Springs, in 1874; the Buffalo Trunk Sewer, from 1833 to 1886; and the sewerage of San Diego, Cuba, in 1887.

His connection with The Sanitary Institute dates from the year 1878, when he joined The Sanitary Institute of Great Britain as an Ordinary Member, and in 1879 was elected a Fellow.

L. F.

PROFESSOR T. HAYTER LEWIS, F.S.A., F.R.I.B.A.

(FELLOW.)

Professor T. Hayter Lewis died on December 10th at the age of eighty years. He retired from practice many years

ago, having led an active life and become prominent in his profession.

He was for many years Professor of Architecture at University College, and those who attended his lectures were impressed with his desire to give liberally from his carefully acquired knowledge, as much help as he possibly could, to the students who attended his classes.

Archæology was a subject in which he was much interested. He was a Fellow of the Society of Antiquaries, and an active member of the Palestine Exploration Fund.

He served the Royal Institute of British Architects as Honorary Secretary for some time, and was also one of its Vice-Presidents.

The connection of Professor Lewis with the Sanitary Institute dated from 1882, when he became a member of the Parkes Museum; he was shortly after elected on the Council, and after the incorporation of the Sanitary Institute and Parkes Museum, he remained on the Council until 1892, when his failing health prevented his attendance.

As a member of the Board of Examiners his services were much appreciated, as the Council felt the importance of the architectural profession in connection with sanitation.

Professor Lewis lectured for the Institute, and contributed several papers to the Transactions.

All who knew him will remember his kindly and genial disposition and ready helpfulness in all undertakings with which he was connected.

T. W. C.

EXHIBITS ADDED TO THE MUSEUM.

JUNE TO DECEMBER, 1898.

Pan Closet. From a plumber's stock (unused) to enable students to examine the details of construction. *Mr. Cobham.*

Drain Pipes. Made of paper and canvas. Specimens showing joint. The paper is saturated with coal tar, and the canvas cover with pitch. A 9-in. pipe is said to have been discovered at the same time, through which sewage was then running. *B. F. Caws, R.E.*

Demography Tables from medical officers' reports, including the following cities and towns:—Birmingham, Cardiff, Huddersfield, Liverpool, Newport, Norwich, Nottingham, Sunderland.

CONTRIBUTIONS AND ADDITIONS TO LIBRARY

OCTOBER TO DECEMBER, 1898.

*** *For publications of Societies and Institutions, &c., see under "Academies."*

ACADEMIES (BRITISH).

Glasgow. *Institution of Engineers and Shipbuilders in Scotland.* Transactions, Vol. XLI., 1897-98. 427 pp., 8vo. Glasgow, 1898. *The Institution.*

London. *City of London College.* Calendar, 1898–99. 187 pp., 8vo. London, 1898. *The Secretary.*

——— *Royal Institute of British Architects.* Kalendar, 1898–99. 335 pp., 8vo. London, 1898. *The Institute.*

——— *The Institution of Civil Engineers.* Minutes of Proceedings, Vol. CXXXIV., 1897-98, Part IV., 516 pp. Charter, Supplemental Charters, By-Laws, and List of Members, 223 pp. Brief Subject Index, Vols. CXIX. to CXXXIV., Sessions 1894-95 to 1897-98, 68 pp. 8vo. London, 1898. *The Institution.*

——— *The Medical Society of.* Transactions, Vol. XXI., Oct. 11th, 1897, to May 16th, 1898. 370 pp., 8vo. London, 1898. *The Society.*

——— *Royal College of Surgeons of England.* Calendar, 1898. 339 pp., 8vo. London, 1898. *The College.*

——— *Royal Statistical Society.* Journal of Vol. LXI., Part III., 30th Sept., 1898. 166 pp., 8vo. London. *The Society.*

——— *The Surveyors' Institution.* Revised Index to the Professional Notes, Vols. I.–VIII. (1886–1898). 71 pp., 8vo. London, 1898. *The Institution.*

ACADEMIES (CONTINENTAL).

Bruxelles. *Société Belge de Géologie, de Paléontologie et d'Hydrologie.* Extrait du Bulletin. Tome III., 1888, 6 pp.: Tome VIII., 1894, 19 pp. *W. Whitaker, F.R.S.*

Blake, *Edward, M.D.* On the Study of the Hand for indications of local and general Disease. 53 pp., 8vo. London, 1898. *The Publisher.*

Board of Agriculture. Agricultural Returns. Statistical Tables showing Acreage under Crops and Grass, and number of Horses, Cattle, Sheep, and Pigs in the United Kingdom, with particulars of each county of Great Britain, 1898. 41 pp., 8vo. London, 1898. *The Board.*

——— Leaflets: No. 50, Water Wagtails or "Dishwashers"; 51, The White or Barn Owl; 52, Gooseberry Blight; 53, The Pear-midge. 8vo. London, 1898. *The Board.*

British Columbia. The Year-Book of: its Conditions, its Climate, its Capabilities. 285 pp., 4to. Victoria, B.C., 1897. *Commissioners of Library of Legislative Assembly.*

Budapest. Die Sterblichkeit der haupt- und residenzstadt Budapest in den Jahren 1886–1890 und deren Ursachen von Dr. Joseph von Kőrösy. 355 pp., 4to. Berlin, 1898. *Dr. Joseph von Kőrösy.*

Freebridge Lynn R.D.C. Prevention of Consumption. 3 pp., 8vo. August, 1898. *W. Whitaker, F.R.S.*

Griffith, *Percy, Assoc.M.Inst.C.E.* The Local Government Board and the Protection of Water from Pollution. 7 pp., 4to. Reprint from Journal of Gas Lighting, 1898. *W. Whitaker, F.R.S.*

Hellyer, *S. Stevens.* The Plumber and Sanitary Houses. 5th Edit. 480 pp., 8vo. London, 1893. *The Author.*

Hodson, *George and Frederick W.* Report of, on the extension of the (Loughborough) Waterworks in the Blackbrook Valley. 18 pp., fcap. London, Sept., 1898. *The Authors.*

Holland, *C.* Compulsory Colic for Board Schools. 27 pp., 8vo. London. *Purchased.*

Huddersfield Sanatorium (Description of). Illustrated. Opened Oct. 22nd, 1898. *E. G. Annis, M.R.C.S., D.P.H.*

Kingscote, *Ernest, M.B.* On so-called Spasmodic Asthma, considered from an entirely new standpoint with regard to its radical cure. 18 pp., 8vo. London, 1899. *H. J. Glaisher.*

Local Government Board and Privy Council. Index to Reports of Medical Officers, 1858–93. (I. Subjects; II. Authors.) Prepared by Drs. E. L. Marsh and L. G. Irvine. 103 pp., 8vo. Glasgow, 1895. *Purchased.*

Local Government Board. Tenth Annual Report, 1880-81. Supplement, containing Report and Papers submitted by the Board's Medical Officer on the Use and Influence of Hospitals for Infectious Diseases. (Reprinted with slight amendments.) 373 pp., 8vo. London, 1894. *Purchased.*

——— Dr. Buchanan's Report upon Inquiry as to recent action by the Town Council of West Bromwich in remedy of Insanitary conditions of that County Borough. 6 pp., fcp. London, 1898. *Sir Richard Thorne, K.C.B., F.R.S.*

Massachusetts State Board of Health. Twenty-Ninth Annual Report. 714 pp., 8vo. Boston, 1898. *The Board.*

Maxwell, *William H.* The Removal and Disposal of Town Refuse. 372 pp., 8vo. London, 1898. *The Sanitary Publishing Co., Ltd.*

MEDICAL OFFICERS OF HEALTH AND OTHER SANITARY REPORTS.

Calcutta, 1897 . . .	*J. N. Cook, D.P.H.*
Coventry, 1897	*E. Hugh Snell, M.D., B.Sc.*
Glamorgan C.C., 1897 . .	*W. Williams, M.A., M.D.Oxon.*
Hackney, 1896	*Prof. W. H. Corfield, M.A., M.D.Oxon.*
King's Norton R.D.C., 1897 . .	*Prof. W. H. Corfield, M.A., M.D.Oxon.*
Lambeth, 1897	*Prof. W. H. Corfield, M.A., M.D.Oxon.*
Lancaster C.C., 1897 . .	*Dr. E. Sergeant.*

London, Port of. Half-year to 30th June, 1898 .. .. *W. Collingridge, M.A., M.D.*
Mile End Old Town, 1897 .. *Prof. W. H. Corfield, M.A., M.D.Oxon.*
Newquay, 1897 .. .. *Prof. W. H. Corfield, M.A., M.D.Oxon.*
Salford, 1897 .. .. *C. E. Paget, M.R.C.S., D.P.H.*
St. Luke, Middlesex, 1897 .. *Prof. W. H. Corfield, M.A., M.D.Oxon.*
St. Mary, Islington, 3rd & 4th quarters, 1897, and 1st quarter, 1898 .. .. .. *Prof. W. H. Corfield, M.A., M.D.Oxon.*
St. Mary, Battersea, 1897 .. *Prof. W. H. Corfield, M.A., M.D.Oxon.*
St. Matthew, Bethnal Green, 1897 .. .. .. *Prof. W. H. Corfield, M.A., M.D.Oxon.*
St. Marylebone, 1897 .. *Prof. W. H. Corfield, M.A., M.D.Oxon.*
Staffordshire C.C., 1897 .. *George Reid, M.D., D.P.H.*
Toronto, 1897 .. .. *Prof. W. H. Corfield, M.A., M.D.Oxon.*

Metropolitan Asylums Board. Annual Report of the Ambulance Committee, 1897. 8 pp., fcp. London, 1898. *Prof. W. H. Corfield, M.A., M.D.Oxon.*

Moore, *Col. E. C. S., R.E.* Sanitary Engineering; a Practical Treatise on the Collection, Removal, and Final Disposal of Sewage, and the Design and Construction of Works of Drainage and Sewerage; with a special chapter on the Disposal of House Refuse and Sewage Sludge, and numerous Hydraulic Tables, Formulæ, and Memoranda, including an extensivs series of Tables of Velocity and Discharge of Pipes and Sewers, specially computed by Ganguillet and Kutter's Formula. 621 pp., 8vo. London, 1898. *B. T. Batsford.*

Moscow. *Imperial Russian Technical Society.* Journal of Moscow Branch, Nos. 5–10, 1897, and Nos. 1–5, 1898. 4to. *The Sanitary Committee of the Society.*

O'Neill, *Henry, M.D.* Recent Advances in Brain Surgery. 18 pp., 8vo. Belfast, 1898. *The Author.*

Palmberg, *Dr. Albert.* Translated and edited by Dr. Arthur Newsholme. A Treatise on Public Health and its applications in different European countries. Second edition. 539 pp., 8vo. London, 1895. *Purchased.*

Palmberg, *Dr. Albert.* In welcher Art soll die physische Erziehung der Schulkinder angeordnet werden? 11 pp. 1898.

——— Lungsotens Förhallande till Arstiderna och till de Epidemiska Sjukdomarne. 10 pp. 1898.

——— Relation de la Phthisie pulmonaire aux saisons et aux maladies épidémiques. 3 pp. *The Author.*

Patent Office. Abridgements and Specifications, period 1889—92. Class 5, Agricultural Appliances. 13, Bells, Gongs, &c. 26, Closets and Sanitary Appliances. 30, Cutlery. 43, Fastenings—Dress, &c. 44, Fastenings—Lock, Latch, Bolt, and other. 46, Filtering and Purifying Liquids. 52, Furniture and Upholstery. 60, Grinding and Burnishing. 65, Hinges, &c. 66, Hollow-ware. 69, Hydraulic

Machinery. 74, Lacemaking, Knitting, Netting, Braiding, and Platting. 80, Mechanism and Mill Gearing. 87, Moulding Plastic and Powdered Substances. 94, Packing and Baling Goods. 104, Railways and Tramways. 107, Roads and Ways. 111, Sewage, Treatment of. 112, Sewing and Embroidering. 117, Sifting and Separating. 118, Signalling and Indicating by Signals. 124, Stone, Marble, and the like, Cutting and Working. 128, Tables, Articles, and Appliances. 133, Trunks, Portmanteaus, &c. 135, Valves and Cocks. 140, Waterproof and similar fabrics. 4to. London, 1898. *H. M. Patent Office.*

Ravenhill, *Miss Alice.* Elements of Sanitary Law. 44 pp., 8vo. London, 1898. *The Author.*

Rideal, *Samuel, D.Sc.* Disinfection and Disinfectants, together with an account of the Chemical substances used as Antiseptics and Preservatives. 372 pp., 8vo. London, 1898. *The Sanitary Publishing Co., Ltd.*

Rome. Annali d'Igiene Sperimentale e diretti dal Prof. Angelo Celli. Vol. VIII. (Nuova Serie), Fasc I. and II., 1898. 290 pp., 8vo. Roma, 1898. *Prof. A. Celli.*

Salford. Annual Report of the Hospital Department for the Year ended Dec. 31st, 1896. 24 pp., 8vo. Salford, 1897. *Prof. W. H. Corfield, M.A., M.D.Oxon.*

Staffordshire County Council. Special Report on the Isolation Hospitals Act, 1893, by the County Medical Officer (George Reid, M.D., D.P.H.). 18 pp., 8vo. Nov. 1st, 1898. *The Author.*

Thresh, *J. C., M.D., D.Sc., D.P.H.* A Simple Method of Water Analysis, especially designed for the use of Medical Officers of Health. 56 pp., 16mo. London, 1898. *The Author.*

Terrile, *Dott Eugenio.* Le Iniezioni Ipodermiche di Ferro nella cura delle Anemie. 8 pp., 8vo. Milano. *The Author.*

Wilson, *George, M.A., M.D., LL.D., F.R.S.Edin.* A Handbook of Hygiene and Sanitary Science. (Eighth Edition.) 798 pp., 8vo. London, 1898. *J. & A. Churchill.*

Whitaker, *W., F.R.S.* Hampshire Well Sections. Extracted from Proceedings Hampshire Field Club, Vol. IV., Part I. 25 pp., 8vo. *The Author.*

LAW REPORTS.

It has been suggested to the Council that it would be a convenience to many of the members to be able to refer to the full text of important legal decisions on questions bearing upon Public Health. They have, therefore, decided to obtain and place in the Library the Law Reports issued by the Incorporated Council of Law Reporting for England and Wales.

The cases bearing upon Public Health that appear in these reports will be noted each quarter in the Journal of the Insti-

tute, and a reference made to the page of the Law Reports on which the full account of the case is given.

Cases of interest in the Magistrates' Courts will also be noted in the Journal.

PARKER *v.* ALDER.

ADULTERATION.—*Food (and Drugs)—Milk—Liability of innocent Vendor for Milk adulterated in transit—Sale of Food and Drugs Act, 1875 (38 & 39 Vict., c. 63), s. 6—Sale of Food and Drugs Act Amendment Act, 1879 (42 & 43 Vict., c. 30), s. 3.*

The Respondent, a milk salesman, contracted to supply pure milk to an Association. The milk was to be delivered to the Association at a Railway terminus in London. The Respondent delivered the milk in a pure and unadulterated condition to the servants of the Railway Company at his local station, and the milk was adulterated without his knowledge or consent during the transit from the local station to the terminus.

Held: That the Respondent was liable to be convicted under s. 6 of the Sale of Food and Drugs Act, 1875.

For full report of this case see "Law Reports," page 20, which can be referred to in the Library of the Institute.

FORMALIN AND MILK.—Before the Liverpool stipendiary, on Wednesday, Samuel Wainwright, a milk dealer, was summoned for having sold separated milk which was not of the nature, substance, and quality demanded. The defendant, it was stated, was asked for separated milk, and supplied a mixture of that and formalin. The use of formalin, it was explained, enabled stale milk to be sold as fresh and tended to obviate the necessity of cleanliness in the dairy. It also rendered milk indigestible with an irritant action on the mucous membrane, especially where young and delicate children were concerned. Mr. M. Collingwood Williams, public analyst, and Professor Boyce, Professor of Pathology at University College, said that formalin was quite unnecessary and most objectionable when used in milk. Though it was not as yet very common, its use was increasing in Liverpool. On the other side, Mr. Davies, analyst, and Dr. Barrow were called to prove that the proportion of formalin stated to have been used in the milk was not injurious to health. The magistrate declared himself on the side of the cow against the chemist. He thought formalin was injurious to health, and ought not to be put into milk. A fine of £5 and costs was imposed. Notice of appeal was given.—*The Times, December 23rd*, 1898.

GENERAL NOTE.

HUDDERSFIELD SANATORIUM.—The County Borough of Huddersfield have just completed a Sanatorium and Infectious Hospital at a cost of about £30,000, and have published a description of the Buildings giving details of the arrangements and the staff. The description is illustrated with views both of the interior and exterior, and also several plans, showing the positions of the various blocks and offices.

GENERAL INDEX.

PRELIMINARY PROGRAMME

OF THE

SEVENTEENTH CONGRESS

TO BE HELD AT

BIRMINGHAM,

FROM 27th SEPTEMBER TO OCTOBER 1st, 1898.

THE

SEVENTEENTH CONGRESS, 1898.

WILL BE HELD AT

BIRMINGHAM.

From SEPTEMBER 27th to OCTOBER 1st.

GENERAL ARRANGEMENTS.

ADDRESSES AND LECTURES.

President's Inaugural Address.
Lecture to the Congress.
Popular Lecture.

SECTIONS.

Section I.—Sanitary Science and Preventive Medicine.
Section II.—Engineering and Architecture.
Section III.—Chemistry, Physics, and Biology.

CONFERENCES.

Of Municipal Representatives.
Of Medical Officers of Health.
Of Municipal and County Engineers.
Of Sanitary Inspectors.
Of Ladies on Domestic Hygiene.

EXHIBITION.

An Exhibition of Apparatus and Appliances relating to Health and of Domestic use will be held in connection with the Congress.

PAPERS AND DISCUSSIONS.

The Council invite Papers on subjects relating to Health and Sanitary Science. Papers are limited to twenty minutes in reading. A short abstract must accompany every Paper, both for the convenience of the Press at the Congress and for insertion, subject to the approval of the Council, in the Journal of the Institute, should it not be deemed desirable to publish the Paper *in extenso*. No previously published Paper can be read. The acceptance of Papers, and the days on which they are to be read, are determined by the Council before the beginning of the Meeting. The Council reserve the right of refusing any Papers sent in; and in the case of those accepted, the reading of them must depend on the time at the disposal of the Meeting. Papers read at the Congress cannot be published by the Authors, except by permission of the Council. The Council reserve to themselves the privilege of printing any Paper read at the Congress, either wholly or in part, or of refraining from the publication thereof, if they see fit.

The Addresses and Papers or Abstracts thereof are usually printe by the Institute in London before the meeting of the Congre and may be purchased from the Secretary of the Institute duri the Congress. Authors should forward their manuscript by po as early as possible, and in any case not later than *August 27* addressed to the Secretary, Sanitary Institute, Margaret Stre London, W.

RECEPTION ROOM AND PLACES OF MEETING.

A Reception Room will be opened at THE TOWN HALL, Monday, SEPTEMBER 29TH, at 12 NOON, and on the following da at 9 A.M. for the issue of all Tickets in connection with t Congress. The Reception Room will be available for Readin Writing, and Conversation.

The Inaugural Address of the President will be given in T LARGE LECTURE THEATRE OF THE BIRMINGHAM AND MIDLA INSTITUTE. The Lecture to the Congress will be given in MAS UNIVERSITY COLLEGE.

The Sectional Meetings, General Meetings, and Conferences wi be held in MASON UNIVERSITY COLLEGE.

The Popular Lecture will be given in THE LARGE LECTU THEATRE OF THE BIRMINGHAM AND MIDLAND INSTITUTE.

HOTEL AND LODGING ACCOMMODATION, AN TRAVELLING ARRANGEMENTS

Will be determined by the Local Committee, and information relati to the same may be obtained from the Honorary Local Secretarie COUNCIL HOUSE, BIRMINGHAM, and from the Secretary of t Institute.

TICKETS.

Fellows, Members, and Associates of the Institute, are suppli with Tickets for the Congress on application to the Secretary befo the Congress, or may be obtained at his Office in THE TOWN HA during the Meeting.

To those not connected with the Institute, Congress Tickets w be issued, entitling the holder to the use of the Reception Room, admission to the Presidential and other Addresses, to all Meeting to the Exhibition of the Institute, and to any Conversazione give by the Institute. The price of the Congress Tickets is Half-a-guine each. These Tickets may be obtained at the Office of the Ho Local Secretaries at THE COUNCIL HOUSE, BIRMINGHAM, or at t Offices of THE INSTITUTE, 72, Margaret Street, London, W.

EXCURSIONS.

Particulars of these will be published in a later Programme, an Tickets and List of Places to be visited can be obtained either at t Secretary's Office, or the Office of the Hon. Local Secretaries durin the Meeting.

Officers of the Institute for 1898-99.

Patroness.
H.R.H. THE DUCHESS OF ALBANY.

President.
H.R.H. THE DUKE OF CAMBRIDGE, K.G.

Past Presidents.
HIS GRACE THE DUKE OF NORTHUMBERLAND, K.G., D.C.L., LL.D.
HIS GRACE THE DUKE OF WESTMINSTER, K.G.

Vice-Presidents.
HIS GRACE THE ARCHBISHOP OF CANTERBURY, P.C., D.D.
RIGHT HON. EARL FORTESCUE.
SIR FREDK. ABEL, BART., K.C.B., D.C.L., D.SC., HON.M.INST.C.E., F.R.S.
SIR HENRY W. ACLAND, BART., K.C.B., M.D., D.C.L., F.R.S.
SIR DOUGLAS GALTON, K.C.B., D.C.L., LL.D., F.R.S. *(Treasurer.)*
SIR W. GUYER HUNTER, K.C.M.G., Q.H.S., M.D., LL.D., F.R.C.P.
SIR FRANCIS SHARP POWELL, BART., M.P.
SIR ROBERT RAWLINSON, K.C.B., M.INST.C.E. (deceased).
SIR HENRY THOMPSON, M.B., F.R.C.S.
PROF. W. H. CORFIELD, M.A., M.D.OXON., F.R.C.P., HON.A.R.I.B.A.
THOMAS SALT, M.A., D.L., J.P.
A. WATERHOUSE, R.A., LL.D, F.R.I.B.A.

Registrar.
SIR W. GUYER HUNTER, K.C.M.G., Q.H.S., M.D., LL.D., F.R.C.P.

Council.
SIR DOUGLAS GALTON, K.C.B., D.C.L., LL.D., F.R.S., *Chairman.*

PROF. HENRY ADAMS, M.INST.C.E.
LEWIS ANGELL, M.INST.C.E., F.R.I.B.A.
†BUSHELL ANNINGSON, M.A., M.D.
H. E. ARMSTRONG, D.HY., M.R.C.S.
*A. WYNTER BLYTH, BARRISTER-AT-LAW, M.R.C.S., F.I.C., F.C.S.
*H. PERCY BOULNOIS, M.INST.C.E.
†W. COLLINGRIDGE, M.A., M.D., LL.M., D.P.H.
H. H. COLLINS, F.R.I.B.A.
*THOMAS W. CUTLER, F.R.I.B.A.
*ROGERS FIELD, B.A., M.INST.C.E.
†MAJOR LAMOROCK FLOWER, F.R.MET.SOC.
*E. T. HALL, F.R.I.B.A.
†PROF. A. BOSTOCK HILL, M.D., D.P.H.
LIEUT.-COL. A. S. JONES, V.C., ASSOC. M.INST.C.E.
†H. R. KENWOOD, M.B., L.R.C.P., D.P.H.
BALDWIN LATHAM, M.INST.C.E., F.G.S., F.S.S.
*†HENRY LAW, M.INST.C.E.
CHARLES MASON, ASSOC.M.INST.C.E., A.R.I.B.A.
†E. G. MAWBEY, M.INST.C.E.
R. E. MIDDLETON, M.INST.C.E.
*ARTHUR NEWSHOLME, M.D., F.R.C.P., D.P.H.
*PROF. J. LANE NOTTER, M.A., M.D.
*LOUIS C. PARKES, M.D., D.P.H.
J. WALLACE PEGGS, ASSOC.M.INST. C.E.
G. VIVIAN POORE, M.D., F.R.C.P.
*GEORGE REID, M.D., D.P.H.
PROF. H. ROBINSON, M.INST.C.E.
*J. OSBORNE SMITH, F.R.I.B.A.
†J. F. J. SYKES, D.SC., M.D.
*W. C. TYNDALE, M.INST.C.E.
†DAWSON WILLIAMS, M.D., F.R.C.P.

* Judges of the Exhibition. † Referees of the Congress.

Auditors.
W. COLLINGRIDGE, M.A., M.D., LL.M., D.P.H.
ALFRED LASS, WOOD & CO.

Hon. Solicitor.
BASIL FIELD, B.A.

Secretary.
E. WHITE WALLIS, F.S.S.

Bankers.
THE UNION BANK, REGENT STREET BRANCH.

OFFICES—PARKES MUSEUM, MARGARET STREET, LONDON, W.

VICE-PRESIDENTS—*continued.*

J. W. WILLIS BUND, J.P., Chairman Worcestershire County Council.
EDWARD ORFORD SMITH, Esq., Town Clerk, Birmingham.
ROBERT SAUNDBY, M.D., LL.D., F.R.C.P., President of the Council of the British Medical Association.
STEPHEN GATELY, Chairman Birmingham Board of Guardians.
The Rev. E. F. M. MACCARTHY, M.A., Chairman Birmingham School Board.
R. S. HEATH, M.A., D.SC., Principal Mason University College.
Alderman Colonel ASH, J.P., Chairman of the Estates Committee of the City Council.
Alderman BAKER, J.P., Chairman of the Improvement Committee of the City Council.
Alderman CLAYTON, J.P., Chairman of the Finance Committee of the City Council.
Alderman JOHNSON, J.P., Chairman of the Free Libraries Committee of the City Council.
Alderman LLOYD, J.P., Chairman of the Lunatic Asylums Committee of the City Council.
Alderman LAWLEY PARKER, J.P., Chairman of the Water Committee of the City Council.
Alderman POLLACK, J.P., Chairman of the Gas Committee of the City Council.
Councillor JOHNSON, Chairman of the Baths and Parks Committee of the City Council.
Councillor JOHNSTONE, J.P., Chairman of the Art Gallery Purchase Committee of the City Council.
Councillor JONES, J.P., Chairman of the Industrial School Committee of the City Council.
Councillor MARTINEAU, Chairman of the Technical School Committee of the City Council.
Councilor WATERS, Chairman of the Watch Committee of the City Council.
WHITWORTH WALLIS, F.S.A., Senior Vice-President, Birmingham and Midland Institute.
ISAAC AVERILL, J.P.
W. G. BAGNALL.
ROLAND J. BEECH, J.P.
GEORGE CADBURY, D.L., J.P.
G. H. CARTLAND, Chairman King's Norton Parish Council.
ALEXR. M. CHANCE, J.P., F.C.S.
FREDERICK ELKINGTON, D.L., J.P.
WILLIAM EVANS, J.P., Chairman of Sanitary Committee, Warwickshire County Council.
W. F. INGE, J.P.
C. PELHAM LANE, D.L., J.P.
H. R. FAIRFAX LUCY, J.P.
FRANCIS STANIER, D.L., J.P.
THOMAS VALE, J.P.
H. A. WAKEMAN-NEWPORT, J.P.
FRED SMITH, J.P., Chairman of the Aston Manor Urban District Council.
JAMES ROLLASON, J.P., Chairman of the Erdington Urban District Council.
E. HADDON, J.P., Chairman of the Nuneaton and Chilvers Coton Urban District Council.
J. K. BOURNE, J.P., Chairman of the Atherstone Rural District Council.
HOWARD P. RYLAND, J.P., Chairman of the Castle Bromwich Rural District Council.
EDWARD PETRE, J.P., Chairman of the Coventry Rural District Council.
G. W. TAYLOR, J.P., Chairman of the Nuneaton Rural District Council.
W. H. WORTH TOWNSEND, J.P., Chairman of the Rugby Rural District Council.
J. COVE JONES, J.P., F.S.A., Chairman of the Stratford-on-Avon Rural District Council.
JOSEPH W. FITCH, J.P., Chairman of the Bromsgrove Urban District Council.
W. CORBETT, Vice-Chairman of the Bromsgrove Urban District Council.
CHARLES SHOWELL, J.P., Chairman of the Oldbury Urban District Council.
FREDK. J. HASKEW, J.P., Chairman of the Stourbridge Urban District Council.
E. A. BALDWIN, J.P., Chairman of the Stourport Urban District Council.
The Rev. C. STOCKDALE, J.P., Chairman of the Bromsgrove Rural District Council.
THOMAS HADLEY, J.P., Chiarman King's Norton Rural District Council.
ENOCH HORTON, J.P., Chairman Darlaston Urban District Council.
WILLIAM MOOR, J.P., Chairman of the Martley Rural District Council.
Major HUDSON, J.P., Chairman of the Pershore Rural District Council.
Rev. W. H. R. LONGHURST, J.P., Chairman of the Upton-on-Severn Rural District Council.
H. W. HOWE, J.P., Chairman of the Yardley Rural District Council.
R. A. HARPER, J.P., Chairman of the Bilston Urban District Council.
E. W. PEARSON, J.P., Chairman of the Brierley Hill Urban District Council.
C. OSBORNE ELLIS, J.P., Chairman of the Perry Bar Urban District Council.
THOMAS BUTLER, J.P., Chairman of the Quarry Bank Urban District Council.
WALTER BASSANO, J.P., Chairman of the Rowley Regis Urban District Council.
WILLIAM SEABROOK, J.P., Chairman of the Rugeley Urban District Council.
JOHN HUGHES, J.P., Chairman of the Sedgley Urban District Council.
JOHN KENDRICK, J.P., Chairman of the Stone Urban District Council.
CLEMENT H. BARROW, J.P., Chairman of the Tipton Urban District Council.

Hon. Local Treasurer.

COUNCILLOR R. F. MARTINEAU.

Hon. Local Secretaries.

PROF. A. BOSTOCK HILL, M.D., D.P.H. | W. BAYLEY MARSHALL, M.INST.C.E.

J. E. WILLCOX, ASSOC.M.INST.C.E.

Local General Committee.

THE RT. HON. THE LORD MAYOR OF BIRMINGHAM (COUNCILLOR CHARLES G. BEALE), *Chairman.*

E. J. ABBOTT.
G. E. ABELL.
PERCY ADAMS.
W. J. ADAMS.
T. J. ADDENBROOKE.
W. A. ADDINSELL.
Councillor ADIE.
W. de LACY AHERNE.
OSMUND AIRY, M.A.
CHARLES AKRILL, J.P.
ARTHUR ALBRIGHT.
W. A. ALBRIGHT.
G. E. ALLAN, B.SC.
Councillor ALLEN.
Professor F. J. ALLEN, M.D.
C. H. ALLISON.
THOMAS ANDERTON.
EDWARD ANSELL, J.P.
JOSEPH ANSELL.
J. H. ARCHER.
DANIEL ARKELL.
W. ARUNDEL.
Alderman ASH, J.P.
W. SMEDLEY ASTON.
ION ATKINS.
W. BEILBY AVERY.
E. W. BADGER.
T. R. BAILEY, M.D.
Alderman BAKER, J.P.
Councillor BAKER, J.P.
C. F. BAKER, M.D.
J. H. BAKER.
OLIVER BAKER.
PHILIP BAKER.
S. H. BAKER.
Councillor BALDEN.
SAMUEL BALDEN.
S. B. BALDEN.
JAMES BALDWIN, J.P.
A. J. BALL.
J. M. BANKS.
Councillor BARBER, J.P.
HARRY BARBER.
S. V. BARBER.
THOMAS BARCLAY, J.P.
F. F. BARHAM.
ERNEST O. BARK.
Lieut.-Col. F. C. BARKER.
H. GILBERT BARLING, M.B., F.R.C.S.
T. C. BARNES.
FRANK S. BARNETT.
H. B. BARNETT.
C. H. BARNSLEY.
J. BARNSLEY, J.P.
THOMAS BARNSLEY, J.P.
Alderman Dr. BARRATT.
J. W. BARRATT.
JOSEPH BARROWS, J.P.
WALTER BARROW.
EDWARD BARWELL.
WILLIAM BARWELL, J.P.
SIDNEY BARWISE, M.D., D.PH.
Mrs. BASSETT.
CHARLES E. BATEMAN, A.R.I.B.A.
JOHN J. BATEMAN.
PHILIP BATES.
W. BATES.
J. MOORE BAYLEY.
T. A. BAYLISS, J.P.
T. R. BAYLISS, J.P.
GEORGE BEARD, J.P.
GEORGE BEECH.

G. E. BELLISS.
A. S. BENNETT.
HERBERT BENNETT.
R. BENNETT.
S. BENNITT, J.P.
Councillor BERKELEY.
R. E. W. BERRINGTON, ASSOC.M.INST.C.E.
EDWARD BETTRIDGE.
Professor BEVENOT, M.A.
HUBERT BEWLAY, ASSOC.M.INST.C.E.
W. H. BIDLAKE, A.R.I.B.A.
E. J. BIGWOOD, J.P.
G. B. BIRCH.
ALFRED BIRD.
Councillor BISHOP, J.P.
WILLIAM BISHOP.
Councillor BISSEKER.
A. BLACKWELL.
J. GIBBS BLAKE, M.D.
J. H. BLAKENEY.
JOHN BLAKEWAY, F.R.C.V.S.
EDWARD BLISS, J.P.
The Rev. J. C. BLISSARD, M.A.
F. MILNES BLUMER, M.B.
G. A. BOEDDICKER.
G. F. BOLDING, J.P.
F. S. BOLTON, J.P.
J. S. BOLTON, M.D.
W. ASHBY BOLTON.
EDWARD BOSWORTH, J.P.
A. BOTTLE, M.D.
Sir T. F. BOUGHEY, Bart.
Councillor BOWATER.
JOHN BOWEN, J.P.
Alderman BOWKETT.
The Rt. Hon. The EARL OF BRADFORD
ISAAC BRADLEY.
C. B. BRAGG.
J. FRANCIS BRAME, J.P.
GEORGE BREWERTON, B.A.
Professor T. W. BRIDGE, D.SC.
J. F. BRILEY.
W. A. BROCKINGTON, M.A.
G. G. BRODIE, J.P.
JOSIAH BROOKES.
WALTER BROOKS.
J. W. B. BROWN, J.P.
T. L. MURRAY BROWNE.
H. F. BRYSON.
H. T. BUCKLAND.
HENRY BUCKLEY.
A. E. BUCKTON.
A. G. BULLER, J.P.
J. W. WILLIS BUND, M.A., LL.B., J
J. THACKRAY BUNCE, J.P.
WILLIAM BUNCHER.
Professor F. W. BURSTALL, M.A.
The Rev. F. W. BURBIDGE, M.A.
F. M. BURTON.
R. P. BUTLER.
W. BUTLER.
W. W. BUTLER, F.C.S.
GEORGE CADBURY.
JOEL CADBURY.
RICHARD CADBURY, J.P.
ALFRED CADDICK.
G. HOLT CALDICOTT.
Lieut.-Gen. The Hon. SOMERSET CALTHORPE.
J. B. CARSLAKE, B.A.
Professor A. H. CARTER, M.D.
ERIC CARTER.

LOCAL GENERAL COMMITTEE—*continued.*

Mrs. ERIC CARTER.
G. H. CARTLAND.
J. F. H. CARTLAND, J.P.
J. HOWARD CARTLAND, J.P.
F. C. B. CAVE.
ALBERT CAY, J.P.
ARTHUR CHAMBERLAIN, J.P.
AUSTEN CHAMBERLAIN, M.P.
The Rt. Hon. J. CHAMBERLAIN, M.P.
WALTER CHAMBERLAIN, J.P.
A. DE PEYSTER CHANCE.
ALEXANDER M. CHANCE, J.P.
ARTHUR L. CHANCE.
JOHN H. CHANCE.
D. CHARLES.
E. J. CHARLES.
WALTER CHARLTON.
H. H. CHATTOCK, J.P.
Miss FRANCES E. CHATTOCK.
T. F. CHAVASSE, M.D., J.P.
EDWIN CHESSHIRE, F.R.C.S.
J. A. CHRISTIE.
HARRY CLARK.
J. B. CLARKE, J.P.
G. H. CLAUGHTON, J.P.
AUGUSTUS CLAY, M.D.
Alderman CLAYTON, J.P.
J. HAZLEWOOD CLAYTON, M.D.
W. J. CLUCAS.
J. B. COCHRANE, J.P.
A. H. COLEY.
HOWARD J. COLLINS.
J. COLLINS.
J. T. COLLINS, J.P.
The Rt. Hon. JESSE COLLINGS, M.P.
The Rev. W. H. COLMORE, M.A.
JOHN CONCHAR, J.P.
THOMAS COND.
Alderman COOK, J.P.
S. W. COOKE.
J. A. COOPER, J.P.
E. S. COPE.
FREDERICK CORBETT.
JOHN CORBETT, J.P.
W. CORBETT.
JETHRO A. COSSINS.
C. H. COUSINS.
R. E. COUCHMAN.
The Right Rev. THE LORD BISHOP OF COVENTRY.
W. H. COX.
JOHN CRAIG, M.D.
F. W. FRANKLIN CROSS, M.S.A.
Miss H. E. G. DALE.
JOSEPH DAVENPORT.
ROBERT DAVENPORT.
HERMAN DAVID.
Councillor DAVIS.
ARTHUR H. DAVIS.
W. J. DAVIS.
J. H. DAWES, F.R.C.V.S.
ERNEST DAY, F.R.I.B.A.
H. DAY, J.P.
A. R. DEAN, J.P.
NOAH DEEKS.
G. DAWSON DEELEY.
WM. DERRY.
Councillor DEXTER.
GEORGE DEVALL.
W. R. DEYKIN.
SAMUEL DIBBLE.
H. E. DIXEY, M.D.
ARTHUR S. DIXON, M.A.
CHARLES DIXON.
DUDLEY DOCKER.
EDWIN DOCKER.
LUDFORD DOCKER.
SIMEON DOGGETT.
CHARLES DORNTON.
RUDOLF DOTZAUER.
WM. DOUBLEDAY.
RICHARD DRURY, M.D., B.A.
JOHN S. DUGDALE, Q.C., J.P.
HENRY DUMOLO.
A. J. DUNN, A.R.I.B.A.
JOHN G. DUNN, A.R.I.B.A.
J. T. EAYRS, M.INST.C.E., F.S.I.
H. TRAVERS EDGE.
R. W. EDGINTON, M.D.
H. W. EDMUNDS.
Alderman EDWARDS, J.P.
ALLEN EDWARDS.
FREDERICK ELKINGTON, D.L., J.P.
G. M. ELKINGTON.
H. F. ELKINGTON.
LEIGH H. ELKINGTON.
JAMES B. ELKINGTON.
H. W. ELLIOTT, J.P.
R. J. ELWELL.
The Rev. G. J. EMANUEL, B.A.
A. ENTWISTLE.
OLIVER ESSEX, F.R.I.B.A.
WALTER EVANS, J.P.
WALTER H. EVANS, J.P.
FREDERICK EVERITT.
G. A. EVERITT, J.P.
ALDERMAN FALLOWS, J.P.
JOSEPH FARNDALE.
ALFRED FEENEY.
JOHN FEENEY, J.P.
RICHARD FENWICK.
H. C. FIELD, J.P.
WILLIAM FIDDIAN, F.S.I.
SYDNEY FISHER.
WALTER N. FISHER, J.P.
J. W. FITCH.
Councillor FLETCHER.
EDWIN FLETCHER.
GEORGE FLETCHER.
H. H. FLETCHER.
C. F. B. FLINT.
OLIVER FLOYD, F.I.A.S.
J. H. FORRESTER.
T. E. FORSYTH.
G. H. FOSBROKE.
W. E. FOWKES.
HENRY FOWLER.
WILLIAM FOWLER.
A. D. FOULKES.
Professor A. FOXWELL, M.A., M.D., F.R.C.P.
H. C. D. FRANCE.
W. H. FRANCE.
Professor FRANKLAND, PH.D., B.SC., F.R.S.
LEONARD GAMGEE, F.R.C.S.
The Rev. Dr. GARDINER.
STEPHEN GATELEY.
F. D. GIBBONS.
T. J. GILBERT.
THOMAS GILBERT, J.P.
WILLIAM GILLIVER, J.P.
ARTHUR GLADSTONE.
HENRY GLAISYER.
Councillor GODLEE.
EDWARD M. GOODMAN.
F. B. GOODMAN, J.P.
G. F. GOODMAN.
JOHN GOODMAN.
J. D. GOODMAN, J.P.
F. S. GOODWIN.
W. F. GORDON.
JOSEPH GOTHARD
M. H. RYAN GRANT.
The Rev. Canon GREANEY.
A. D. GREATOREX, ASSOC.M.INST.C.E.
Councillor GREEN, J.P.
W. F. GREEN, J.P.

LOCAL GENERAL COMMITTEE—*continued.*

LISTER LEA, Junr.
E. H. LEE.
E. ANTONY LEES.
J. BAYLEY LEES, J.P.
H. R. LEECH, J.P.
C. A. LEEDHAM-GREEN, F.R.C.S.
P. H. LEVI.
JOSEPH LEWIS.
C. J. LEWIS, M.D.
D. E. LLOYD-DAVIES.
Alderman LLOYD, J.P.
S. S. LLOYD, Junr., J.P.
HOWARD LLOYD.
LEWIS LLOYD.
Professor JORDAN LLOYD, F.R.C.S.
Councillor LLOYD, J.P.
Councillor J. H. LLOYD, J.P.
S. S. LLOYD, J.P.
G. H. LLOYD, J.P.
F. W. LINDNER.
MAX LINDNER.
J. COURTENAY LORD, J.P.
W. WYLEY LORD.
THOMAS LOUD.
F. W. LOWE, M.P.
JOHN LOWE, J.P.
Mrs. THOMAS LOWE.
S. R. LOWCOCK, ASSOC.M.INST.C.E.
C. A. LOXTON, F.R.C.S.
ALBERT LUCAS.
W. R. LUDLOW, J.P.
EDWIN LUDLOW.
ALFRED LUDLOW.
HARRY LUDLOW.
RANDLE N. LUNT.
G. F. LYNDON, J.P.
The Rev. E. F. M. MACCARTHY, M.A.
W. T. MADIN, L.D.S.
J. MALCOLM, F.R.C.V.S.
HENRY MALET, M.D.
Professor E. MALINS, M.D., J.P.
HERBERT MANLEY, M.A., M.B., D.P.H.
JOHN MANLEY, J.P.
W. S. MANN.
Alderman MANTON, J.P.
H. J. MANTON, J.P.
EDWARD MAPPLEBECK, J.P.
H. MARGETTS.
J. A. MARIGOLD.
EDWARD MANSELL.
Councillor MARSH.
FRANK MARSH, F.R.C.S.
W. BAYLEY MARSHALL, M.INST.C.E.
W. P. MARSHALL.
C. F. MARSTON, ASSOC.M.INST.C.E.
E. R. MARTEN, M.INST.C.E.
CHRISTOPHER MARTIN.
F. W. MARTIN.
WILLIAM MARTIN.
Councillor MARTINEAU.
ERNEST MARTINEAU.
C. E. MATHEWS, M.A., J.P.
G. S. MATHEWS, M.A.
Professor BENNETT MAY, M.B., F.R.C.S.
WALTER MAY.
ROBERT MAYO.
The MAYOR OF COVENTRY.
The MAYOR OF DUDLEY.
The MAYOR OF LEAMINGTON.
The MAYOR OF LEICESTER.
The MAYOR OF LICHFIELD.
The MAYOR OF WARWICK.
The MAYOR OF WEDNESBURY.
The MAYOR OF WEST BROMWICH.
The MAYOR OF WOLVERHAMPTON.
The MAYOR OF STRATFORD-ON-AVON.
The MAYOR OF SUTTON COLDFIELD.
G. H. MELSON, M.D.
J. B. MELSON, M.D., J.P.
C. T. MENKE.
J. H. R. MEYER.
JOHN T. MIDDLEMORE, J.P.
THOMAS MIDDLEMORE.
J. MILLIGAN.
R. HARDING MILWARD, J.P.
VICTOR GRAHAM MILWARD.
A. BRUCE MITCHELL.
E. G. MITCHELL.
F. W. V. MITCHELL.
HENRY MITCHELL.
JAMES MOFFAT.
J. J. R. MOGG.
FREDERICK M. MOLE.
HERBERT H. MONCKTON.
ALFRED MORCOM, M.INST.C.E.
G. H. MORLEY.
G. J. MORRIS, R.E.
F. A. C. MORRISON, B.A.
CHARLES G. MOUNTAIN.
Professor J. H. MUIRHEAD, M.A.
H. L. MULLER.
W. MULLINER.
F. E. MUNTZ, J.P.
G. F. MUNTZ, J.P.
P. A. MUNTZ, M.P.
Councillor MURRAY.
F. W. NASH.
EDWARD NETTLEFOLD, J.P.
JOHN S. NETTLEFOLD, J.P.
J. W. NEVILLE.
HERBERT NEW.
T. W. F. NEWTON.
H. BERTRAM NICHOLS, ASSOC.M.INST.C.E.
HILL NORRIS, M.D., J.P.
JOHN NORTON.
The Rt. Hon. LORD NORTON.
F. B. OSBORN, F.R.I.B.A.
A. C. OSLER.
A. FOLLETT OSLER, F.R.S.
H. F. OSLER.
D. C. LLOYD OWEN.
SAM OWEN.
W. T. OWEN.
The Rev. Canon MANSFIELD OWEN, M.A.
EDWIN PADMORE.
GEORGE PADMORE.
SYDNEY PADMORE.
H. MARKANT PAGE, M.D., D.PH.
CHAS. A. PALMER.
GEORGE A. PANTON, F.R.S.E.
J. J. PARFITT, B.A.
HENRY PARISH.
Alderman LAWLEY PARKER, J.P.
JOHN PARKER.
J. M. PARKER.
REGINALD PARKER.
Councillor PARKES, M.P.
JOHN I. PARKES, J.P.
EDWIN PARRY.
C. T. PARSONS, J.P.
THOMAS PARSONS.
C. B. PARTRIDGE.
G. H. PAYTON.
HENRY PAYTON, J.P.
F. BARRY PEACOCK.
WILLIAM PEARCE.
H. A. PEARSON.
HOWARD S. PEARSON.
J. H. PEARSON, J.P.
C. O. PEMBERTON.
T. EDGAR PEMBERTON.
J. G. PENTLAND.
C. W. PERKINS.
T. W. PETERSEN.
R. R. PEYTON.
EDWARD PEYTON.

LOCAL GENERAL COMMITTEE—*continued.*

EDWARD R. TAYLOR.
FRANK TAYLOR.
FRANK TARLETON.
JOSEPH TAUNTON.
RICHARD H. TAUNTON.
J. W. TAYLOR.
Councillor THOMAS.
RICHARD THOMAS.
STEPHEN H. THOMPSON.
WM. THOMAS.
T. W. THURSFIELD, M.D.
B. B. TILLEY.
SAMUEL TIMMINS, J.P.
Rear-Admiral TINKLAR.
GEORGE TITTERTON.
Councillor TOLLER.
MICHAEL TOMKINSON, J.P
Councillor TONKS.
A. E. TUCKER.
J. W. TURNER.
N. H. TURNER, M.D.
G. H. TWIGG.
CHARLES TWIST.
E. LANT TYNDALL.
A. S. UNDERHILL, M.D., D.PH.
F. W. UNDERHILL, F.R.C.S.
CHARLES F. VACHELL.
HUGH VALLANCE.
The Rev. A. R. VARDY, M.A.
JOHN C. VAUDREY, M.INST.C.E.
C. A. VINCE.
FELIX VINRACE, M.D.
Sir WILLOUGHBY WADE, J.P.
JOSEPH WAINWRIGHT. J.P.
H. L. WADE.
CHARLES WALLIS J.P.
WHITWORTH WALLIS, F.S.A.
JOHN S. WALFORD.
J. R. WALKER.
SYDNEY WALKER.
T. F. WALKER.
T. J. WALSH.
J. W. WARD.
W. H. WARD.
ARTHUR WARDEN.
CHARLES WARDEN, M.D., J.P.
W. E. WARDEN. J.P.
J. LOXDALE WARREN.
Councillor WATERS.
The Rt. Hon. The EARL OF WARWICK.
THOMAS WATERHOUSE, J.P.
JOHN WEBB.
The Rev. F. S. WEBSTER, M.A.
JOHN WEISS, J.P.
A. L. WELLS, J.P.
C. K. WEST.
A. WESTWOOD.
HENRY WESTWOOD.
Professor E. B. WHITCOMBE, M.R.C.S.
Alderman WHITE, J.P.
WOOD WHITE, M.D.
BENJAMIN WHITEHOUSE.
W. H. WHITELOCK.
ALLAN WHITFIELD.
JAMES WHITFIELD.
S. WHITFIELD.
H. J. WHITLOCK.
W. J. WHITTALL.
Sir HENRY WIGGIN, Bart., J.P.
H. A. WIGGIN, J.P.
W. W. WIGGIN, J.P.
J. St. S. WILDERS, J.P.
J. E. WILLCOX, ASSOC.M.INST.C.E.
Councillor J. WILKINSON.
Councillor WILLIAM WILKINSON.
HOWARD WILKINSON, J.P.
WALTER WILKINSON.
C. J. WILLIAMS, J.P.
FRANCIS WILLIAMS.
J. POWELL WILLIAMS, M.P.
WILFRED WILLIAMS, J.P.
JOHN WILLMOTT.
PHILIP H. WILLMOTT.
A. W. WILLS, J.P.
Councillor WILSON.
GEORGE WILSON, M.A., M.D., LL.D.
JOHN EDWARD WILSON, J.P.
J. W. WILSON, M.P.
H. LLOYD WILSON.
T. STACEY WILSON, M.D.
THOMAS WILSON. M.D., F.R.C.S.
WRIGHT WILSON. F.R.C.S.
Prof. B. C. A. WINDLE, M.A., M.D. B.SC., B.CH.
The Rt. Hon. LORD WINDSOR.
J. WINGFIELD, M.D.
ROWLAND WINN, MUS. DOC.
Councillor WINKLES.
The Rev. F. LUKE WISEMAN, B.A.
FRED. S. WOOD.
The Rev. JOSEPH WOOD, M.A.
The Rt. Rev. THE LORD BISHOP OF WORCESTER.
FRANK WRIGHT, J.P.
WILLIAM WYTHES.
R. P. YATES, J.P.
The Rev. Dr. R. N. YOUNG.
GEORGE ZAIR.
JOHN ZAIR.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

County Councils, Corporations, and Local Authorities, who have up to the present appointed Delegates to the Congress.

County Councils (33).

Aberdeen.
Anglesey.
Bedfordshire.
Cheshire.
Cornwall.
Cumberland.
Derbyshire.
Devon.
Durham.
Elgin.
East Riding, Yorks.
East Sussex.
Flintshire.
Forfar.
Gloucestershire.
Haddington.
Huntingdonshire.
Lancashire.
Leicestershire.
Lindsey, Lincolnshire.
Merioneth.
Middlesex.
Northumberland.
Nottingham.
North Riding, Yorks.
Shropshire.
Somerset.
Southampton.
Staffordshire.
Warwickshire.
West Riding, Yorks.
West Suffolk.
Worcestershire.

County Boroughs (45).

Barrow-in-Furness.
Birkenhead.
Birmingham.
Bootle.
Bradford.
Brighton.
Bristol.
Burnley.
Bury.
Cardiff.
Coventry.
Croydon.
Derby.
Dublin.
Dudley.
Edinburgh.
Glasgow.
Gloucester.
Great Yarmouth.
Halifax.
Hanley.
Huddersfield.
Kingston-on-Hull.
Leeds.
Lincoln.
Liverpool.
Manchester.
Newcastle-upon-Tyne.
Newport.
Northampton.
Norwich.
Nottingham.
Oldham.
Portsmouth.
Preston.
Rochdale.
Sheffield.
Southampton.
South Shields.
Stockport.
Sunderland.
West Bromwich.
West Ham.
Wolverhampton.
Worcester.

Urban District Councils or Sanitary Authorities (128).

Abram.
Accrington.
Alfreton.
Audley.
Bacup.
Barnsley.
Bath.
Batley.
Bedford.
Bermondsey Vestry.
Berwick-upon-Tweed.
Biddulph.
Blackpool.
Blackrock.
Bollington.
Bournemouth.
Bridgend.
Bromsgrove.
Burslem.
Camberwell Vestry.
Cambridge.
Chelmsford.
Cheltenham.
Cleethorpes-with-Thrunscoe.
Coatbridge.
Colne.
Connahs Quay.
Cowbridge.
Crewe.
Darlaston.
Drogheda.
Dumbarton.
Eastbourne.
Eccles.
Erdington.
Exmouth.
Faversham.
Festiniog.
Flint.
Forres.
Handsworth.
Haworth.
Hindley.
Horbury.
Innerleithen.
Irvine.
Jarrow.
Kinghorn.
Kingswinsford.
Kirkcaldy.
Kirkintilloch.
Knutsford.
Lanark.

URBAN DISTRICT COUNCILS AND SANITARY AUTHORITIES—(Cont.)

Leigh-on-Sea.
Lewes.
Lichfield.
Linlithgow.
Linthwaite.
Lisburn.
Litherland.
Littleborough.
Liversedge.
Llandudno.
Longton.
Ludlow.
Macclesfield.
Maldon.
Middlewich.
Morley.
Mountain Ash.
Much Woolton.
Nelson.
Newport (Salop)
Nuneaton and Chilvers Coton.
Oldbury.
Old Swindon.
Oswestry.
Otley.
Oxenhope.
Oystermouth.
Perry Bar.
Pollokshaws.
Pontefract.
Pontypridd.
Quarry Bank.
Rawtenstall.
Reigate.
Rotherham.
Rothesay.
Rowley Regis.
Royal Leamington Spa.
Rugby.
St. George-the-Martyr, Southwark.
St. John, Hampstead Vestry.
St. Leonard, Shoreditch.
St. Martin in the Fields.
St. Thomas.
Scarborough.
Scunthorpe.
Seaford.
Shipley.
Smethwick.
Southall, Norwood.
Southport.
Staines.
Stoke-upon-Trent.
Strand Board of Works.
Stratford-upon-Avon.
Sutton Coldfield.
Swindon New Town.
Swinton.
Thornhill.
Tipton.
Tonbridge.
Tunstall.
Tynemouth.
Urmston.
Wakefield.
Wallasey.
Warwick.
Waterloo with Seaforth.
Weymouth.
Whitstable.
Wick.
Windsor.
Winsford.
Wood Green.
Wrexham.

RURAL DISTRICT COUNCILS (36).

Alcester.
Basford.
Bedford.
Bolton.
Bootle.
Brackley.
Braintree.
Bromsgrove.
Bucklow.
Carlisle.
Castle Bromwich.
Claypole.
Clogher Union.
Dover.
Halesowen.
Halifax.
Hemsworth.
Holywell.
Kidderminster.
King's Norton.
Lancaster.
Lichfield.
Lutterworth.
Maidstone.
Maldon.
Middleton Cheney.
Mutford & Lothingland.
Newark.
Newport Pagnell.
New Ross Union.
Overton.
Runcorn.
Warwick.
West Lancashire.
Welwyn.
Wolstanton.

PORT SANITARY AUTHORITIES AND OTHERS (11).

Birmingham Tame and Rea Drainage Board.
Chester Port Sanitary Authority.
Gloucester Port Sanitary Authority.
Haslingden, Rawtenstall, and Bacup Outfall Sewerage Board.
Hull and Goole Port Sanitary Authority.
Liverpool Port Sanitary and Hospitals Committee.
Metropolitan Asylums Board.
Port of London Sanitary Authority.
Richmond Main Sewerage Board.
West Riding of Yorkshire Rivers Board.
Warwick Joint Hospital Board.

SCHOOL BOARDS (9).

Birmingham.
Bradford.
Bristol.
Derby.
London.
Nottingham.
Salford.
Wigan.
Worcester.

Societies who have appointed Delegates to the Congress.

(62)

Anderson's College Medical School.
Apothecaries' Hall, Ireland.
Architectural Association.
Bedford College.
Birmingham Architectural Association.
Birmingham Microscopical and Naturalists' Union.
Birmingham and Midland Institute.
British Association of Waterworks Engineers.
British Institute of Preventive Medicine.
British Medical Association.
Catholic University of Ireland Medical Faculty.
Civil and Mechanical Engineers' Society.
Chemical Society.
Federated Institution of Mining Engineers.
Geologists' Association.
Geological Society.
Institute of Chemistry of Great Britain and Ireland.
Institution of Civil Engineers of Ireland.
Institution of Electrical Engineers.
Institution of Engineers and Shipbuilders in Scotland.
Institution of Junior Engineers.
Institution of Mechanical Engineers.
Irish Medical Association.
Jenner Society.
King's College, London.
Ladies' Sanitary Association.
Liverpool Engineering Society.
Medico-Chirurgical Society, Glasgow.
Midland Branch Society of Medical Officer of Health.
Metropolitan Public Gardens Association.
National Health Society.
North of England Institute of Mining and Mechanical Engineers.
Northern Architectural Association.
North-Western and Midland Sanitary Inspectors' Association.
Owen's College.
Queen's College (Cork).
Royal College of Physicians of London.
Royal College of Surgeons, Ireland.
Royal Academy of Medicine in Ireland.
Royal Institute of Architects of Ireland.
Royal Institute of British Architects.
Royal Medical and Chirurgical Society.
Royal Meteorological Society.
Sanitary Inspectors Association.
St. John Ambulance Association.
School of Medicine of the Royal Colleges, Edinburgh.
Society of Arts.
Society of Chemical Industry.
Society of Engineers.
South Staffordshire and East Worcestershire Institute of Mining Engineers.
Ulster Medical Society.
Ulster Sanitary Association.
University of Aberdeen.
University of Cambridge.
University of Durham.
University of Edinburgh.
University of London.
University College, Bristol.
University College, Dundee.
University College of Wales.
Vegeterian Federal Union.
Yorkshire College.

Proceedings of the Congress and Officers of Sections and Conferences.

Inaugural Address to the Congress

SIR JOSEPH FAYRER, BART., K.C.S.I., M.D.EDIN., F.R.C.P.LOND., F.R.C.S.ENG., LL.D.EDIN. & ST. AND., Q.H.P., F.R.S.,

Conversazione and Reception

THE RT. HON. THE LORD MAYOR (COUNCILLOR CHARLES G. BEALE).

Garden Party

to be given in THE BOTANICAL GARDENS, EDGBASTON, *by* MEMBERS OF THE HEALTH COMMITTEE OF THE CORPORATION OF BIRMINGHAM.

Lecture to the Congress

BY CHRISTOPHER CHILDS, M.A., M.D.OXON., D.P.H., F.C.S., Lecturer on Bacteriology in relation to Hygiene at University College, London.

Popular Lecture

BY ALEX HILL, M.A.CAMB., M.D., M.R.C.S., J.P., Master of Downing College, and Vice-Chancellor of Cambridge University.

For time and places of Meetings see page 21.

SECTIONAL MEETINGS.

Sect. I.—"Sanitary Science & Preventive Medicine."

September 29th and 30th, to be held in MASON UNIVERSITY COLLEGE.

President.

ALFRED HILL, M.D. F.R.S.EDIN., F.I.C.
Medical Officer of Health to the City of Birmingham.

Vice-Presidents.

ALFRED H. CARTER, M.D., F.R.C.P.
THOMAS F. CHAVASSE, M.D., F.R.C.S.
ALD. W. COOK, J.P.
PROF. W. H. CORFIELD, M.A., M.D. OXON., F.R.C.P.
G. H. FOSBROKE, M.R.C.S., D.P.H.CAMB.
T. VINCENT JACKSON, F.R.C.S.EDIN., J.P.
JORDAN LLOYD, M.B.DURH., F.R.C.S.
PROF. J. LANE NOTTER, M.A., M.D., D.P.H.
G. VIVIAN POORE, M.D., F.R.C.P.
GEORGE REID, M.D., D.P.H.
ROBERT SAUNDBY, M.D., LL.D., F.R.C.P.
COUNC. SIR JAMES SMITH, J.P.
T. W. THURSFIELD, M.D., F.R.C.P., J.P.
GEORGE WILSON, M.A., M.D., LL.D., D.P.H.CAMB.
B. ARTHUR WHITELEGGE, B.SC., M.D., D.P.H., F.R.C.P.

Secretaries.

HERBERT MANLEY, M.A.CAMB., M.B., D.P.H., WEST BROMWICH.
T. SYDNEY SHORT, M.D.LOND., D.P.H.CAMB., BIRMINGHAM.

Recording Secretary.

J. F. J. SYKES, D.SC., M.D., LONDON.

Section II.—"Engineering and Architecture."

September 29th and 30th, to be held in MASON UNIVERSITY COLLEGE.

President.

W. HENMAN, F.R.I.B.A.

Vice-Presidents.

LEWIS ANGELL, M.INST.C.E., F.R.I.B.A.
W. G. BAGNALL.
CHARLES E. BATEMAN, F.R.I.B.A.
SIR ALEXANDER R. BINNIE, M.INS.C.E.
H. H. COLLINS, F.R.I.B.A.
JETHRO A. COSSINS.
ERNEST DAY, F.R.I.B.A.
WILLIAM HALE, F.R.I.B.A.
CHARLES HUNT, M.INST.C.E.
HENRY LEA, M.INST.C.E.
JAMES LEMON, M.INST.C.E., F.R.I.B.A.
WILLIAM MARTIN.
EDWARD PRITCHARD, M.INST.C.E., F.G.S., F.R.M.S.
H. ALFRED ROECHLING, ASSOC.M INST.C.E.

Secretaries.

H. T. BUCKLAND, BIRMINGHAM.
S. R. LOWCOCK, ASSOC.M.INST.C.E., BIRMINGHAM.

Recording Secretary.

MAJOR LAMOROCK FLOWER, F.R.MET.SOC., LONDON.

Section III.—"Physics, Chemistry, and Biology."

September 29th and 30th, to be held in MASON UNIVERSITY COLLEGE.

President.

G. SIMS WOODHEAD, M.D., F.R.C.P., F.R.S.EDIN.,
Director Research Laboratories, Conjoint Board of Royal College of Physicians, London, and Royal College of Surgeons, England.

Vice-Presidents.

PROF. F. J. ALLEN, M.D.
F. CAMPBELL BAYARD, L.L.M., F.R. MET.SOC.
PROF. RUBERT BOYCE, M.B.
PROF. FRANK CLOWES, D.SC., F.I.C.
W. J. DIBDIN, F.I.C., F.C.S.
W. H. DINES, B.A., F.R.MET.SOC.
E. W. T. JONES, F.I.C.
PROF. CHARLES LAPWORTH, LL.D., F.R.S., F.G.S.
C. A. LEEDHAM-GREEN, F.R.C.S.
PROF. J. H. POYNTING, D.SC., F.R.S.
THOMAS STEVENSON, M.D., F.R.C.P.
W. WHITAKER, B.A., F.G.S., F.R.S.
JOHN WHITE, F.I.C.

Secretaries.

PROF. PERCY F. FRANKLAND, PH.D., B.SC., F.R.S., BIRMINGHAM.
PROF. O. J. KAUFFMAN, M.D., M.R.C.P., BIRMINGHAM.

Recording Secretary,

BUSHELL ANNINGSON, M.A., M.D., CAMBRIDGE.

CONFERENCES.

Of Municipal Representatives.

Wednesday, September 28th, to be held in MASON UNIVERSITY COLLEGE.

President.

ALD. W. COOK, J.P.
Chairman of Health Committee of the Birmingham City Council.

Vice-Presidents.

RT. HON. EARL BEAUCHAMP (Chairman of Health Committee, Worcester).
RT. HON. ALD. JNO. HOULDING (Lord Mayor of Liverpool).
RT. HON. ALD. C. F. TETLEY (Lord Mayor of Leeds).
ALD. SIR JOHN BLAKER (The Worshipful the Mayor of Brighton).
SIR WILLIAM PINK (Chairman of Sanitary Committee, Portsmouth).
SIR SAMUEL G. JOHNSON (Town Clerk, Nottingham).
ALD. E. H. COOKSON (Chairman of Health Committee, Liverpool).
ALD. T. B. SANDERSON (The Rt. Worshipful the Mayor of Newcastle-upon-Tyne).
ALD. H. NEWTON, J.P. (Chairman of Sanitary Committee, Newcastle-upon-Tyne).
COUNC. COUSINS, J.P. (Chairman of Health Committee, Wolverhampton).
COUNC. N. T. DEWÉ (Chairman of Sanitary Committee, Brighton).
COUNC. ARTHUR LESLIE CROCKFORD (The Worshipful the Mayor of Sutton Coldfield).
COUNC. H. KIMBER (The Worshipful The Mayor of Portsmouth).
COUNC. J. MORTON (Chairman of Sanitary Committee, Coventry).
COUNC. SALTER (Chairman of Sanitary Committee, West Bromwich).
COUNC. B. WOMERSLEY (Chairman of Sanitary Committee, Leeds).

Secretaries.

COUNC. J. H. LLOYD, M.A., J.P., BIRMINGHAM.
E. V. HILEY, BIRMINGHAM.

Recording Secretary.

W. COLLINGRIDGE, M.A., M.D., L.L.M., D.P.H., LONDON.

This Conference is open to all Members and Officials of Municipal Bodies.

Of Medical Officers of Health.

Wednesday, September 28th, to be held in MASON UNIVERSITY COLLEGE.

President.

JOHN C. MCVAIL, M.D.ST.AND., D.P.H.CAMB., F.R.S.EDIN., F.S.S.
Medical Officer of Health, Stirling and Dumbarton County Councils.

Vice-Presidents.

H. E. ARMSTRONG, D.HY., M.R.C.S. (Medical Officer of Health, Newcastle-upon-Tyne).
T. RIDLEY BAILEY, M.D.EDIN. (President of the Birmingham and Midland Branch of the Society of Medical Officers of Health, Medical Officer of Health, Bilston).
PHILIP BOOBBYER, M.B., M.R.C.S. (Medical Officer of Health, Nottingham).
SAMUEL BROWNE, M.D., D.P.H. (Medical Officer of Health, Leamington).
D. S. DAVIES, M.D., D.P.H.CAMB. (Medical Officer of Health, Bristol).
A. WELLESLEY HARRIS, M.R.C.S., D.P.H. (Medical Officer of Health, Southampton).
E. W. HOPE, D.SC., M.D. (Medical Officer of Health, Liverpool).
HENRY MALET, B.A., M.D. (Medical Officer of Health, Wolverhampton).
CHARLES E. PAGET, M.R.C.S., D.P.H. (Medical Officer of Health, Northampton County Council).
MARYN READ, M.D., D.P.H. (Medical Officer of Health, Worcester).
E. C. SEATON, M.D., F.R.C.P. (Medical Officer of Health, Surrey County Council).
E. HUGH SNELL, B.SC., M.D., D.P.H. (Medical Officer of Health, Coventry).

Secretaries.

SIDNEY BARWISE, M.D., D.P.H., DERBY.
A. S. UNDERHILL, M.D., D.P.H., WEST BROMWICH.

Recording Secretary.

HENRY KENWOOD, M.B., D.P.H., LONDON.

This Conference is open to all Medical Officers of Health.

Of Municipal and County Engineers.

Wednesday, September 28th, to be held in MASON UNIVERSITY COLLEGE.

President.

T. DE COURCY MEADE, M.INST.C.E.
City Surveyor, Manchester.

Vice-Presidents.

W. B. G. BENNETT, ASSOC.M.INST.C.E. (Borough Engineer, Southampton).
R. E. W. BERRINGTON, ASSOC.M.INST.C.E.
W. BLACKSHAW, ASSOC.M.INST.C.E. (Borough Engineer, Stafford).
A. T. DAVIS, ASSOC.M.INST.C.E. (County Surveyor, Salop).
JOHN T. EAYRS, M.INST.C.E., F.G.S.
E. PURNELL HOOLEY, ASSOC.M.INST.C.E. (County Surveyor, Nottingham).
FRANCIS J. C. MAY, M.INST.C.E., F.S.I. (Borough Engineer, Brighton).
JOHN PRICE, M.INST.C.E. (City Surveyor, Birmingham).
JOHN WILLMOT (County Surveyor, Warwick).
JNO. ED. WORTH, M.INST.C.E. (District Engineer, L.C.C.).
T. H. YABBICOM, ASSOC.M.INST.C.E. (City Engineer, Bristol).

Secretaries.

H. ASHTON HILL, M.INST.C.E., BIRMINGHAM.
A. D. GREATOREX, ASSOC.M.INST.C.E., WEST BROMWICH.

Recording Secretary.

E. G. MAWBEY, M.INST.C.E., LEICESTER.

This Conference is open to all Municipal and County Engineers.

Of Sanitary Inspectors.

Wednesday, September 28th, to be held in MASON UNIVERSITY COLLEGE.

President.

W. W. WEST.
Chief Sanitary Inspector, Walthamstow; Past Chairman, Sanitary Inspectors' Association.

Vice-Presidents.

WILLIAM BLAND (Chairman North-Western & Midland Sanitary Inspectors' Association.)
BENJAMIN BOLT (Sanitary Inspector, Aston Manor).
G. W. BRANSON (Chairman Northampton and adjoining Counties Branch Sanitary Inspectors' Association).
JOHN BROOK (Sanitary Inspector, Stratford-on-Avon).
KENNETH CAMERON (President of the Sanitary Inspectors' Association of Scotland).
WILLIAM H. CLARKE (Sanitary Inspector, Coventry).
JOHN T. COWDEROY (Chairman Worcestershire Branch Sanitary Inspectors' Association).
THOS. G. DEE (Chairman of Council, Sanitary Inspectors' Association).
W. FRASER, ASSOC.M.INST.C.E. (Chairman South Wales and Monmouthshire Sanitary Inspectors' Association).
CHARLES GANDER (Sanitary Inspector, Alcester R.D.C.).
H. S. HARVEY (Sanitary Inspector, Evesham).
FREDK. T. POULSON (Rivers Pollution and Sanitary Inspector Staffordshire C. C.).
CHARLES MACMAHON (Chairman Western Branch Sanitary Inspectors' Association).
J. T. SHAWCROSS (Chairman Lancashire and Cheshire Branch Sanitary Inspectors' Association).
DAVID TRAVIS (Chairman Yorkshire Branch Sanitary Inspectors' Association).
W. H. WELLS (Chairman Northumberland and Durham Branch Sanitary Inspectors' Association).

Secretaries.

NOAH DEEKS, ERDINGTON. | JOHN PARKER, BIRMINGHAM.

Recording Secretary.

ALBERT TAYLOR, LONDON.

This Conference is open to all Sanitary Inspectors and Inspectors of Nuisances.

On Domestic Hygiene.

Wednesday, September 29th, to be held in MASON UNIVERSITY COLLEGE.

President.

THE LADY MAYORESS (Mrs. C. G. BEALE).

Vice-Presidents.

THE COUNTESS OF WARWICK.
LADY HOLDER.
LADY MARTINEAU.
Mrs. ASHFORD.
Mrs. W. G. BAGNALL.
Mrs. BARNARD.
Mrs. BASSETT.
Mrs. GEORGE CADBURY.
Mrs. A. H. CARTER.
Mrs. A. M. CHANCE.
Dr. ANNIE CLARK.
Miss DALE.
Mrs. C. A. HARRISON.
Miss JOYCE.
Mrs. WILLIAM KENRICK.
Mrs. JORDAN LLOYD.
Mrs. FRANK LOWE.
Mrs. MARSHALL.
Miss MARTINEAU.
Miss MATHEWS.
Mrs. ALFRED C. OSLER.
Mrs. E. PARKES.
Mrs. JOHN PHILLIPS.
Miss STACEY.
Dr. MARY STURGE.
Mrs. VARDY.
Mrs. WINDLE.

Secretaries.

Mrs. BASSETT, BIRMINGHAM.
Mrs. ERIC CARTER, BIRMINGHAM.
Mrs. SARGANT, BIRMINGHAM.

This Conference is open to all Ladies interested in Domestic Hygiene.

Order of Proceedings.

TUESDAY, SEPTEMBER 27TH.

12.30 p.m.—Reception of the Members of the Congress in the Council Chamber, Council House.

1.30 p.m.—Public Luncheon in the Grand Hotel.

3 p.m.—Inaugural Address to the Congress in The Birmingham and Midland Institute.

8.30 p.m.—Opening of the Health Exhibition in Bingley Hall.

WEDNESDAY, SEPTEMBER 28TH.

10 a.m. to 1 p.m., and 2 to 5 p.m.—Conferences in Mason University College.

(*See pages* 18—20).

8.30 p.m.—Conversazione and Reception in the Council House by The Rt. Hon. The Lord Mayor of Birmingham.

THURSDAY, SEPTEMBER 29TH.

10 a.m. to 2 p.m.—Meetings of Section I. (*See pages* 16, 17.)—Sanitary Science and Preventive Medicine. Section II.—Engineering and Architecture. Section III.—Physics, Chemistry, and Biology in Mason University College.

Presidents' Addresses, Papers and Discussions.

Garden Party at Botanical Gardens, Edgbaston, by The Health Committee of the Corporation of Birmingham.

8.30 p.m.—Lecture to the Congress in Mason University College.

FRIDAY, SEPTEMBER 30TH.

10 a.m. to 2 p.m.—Meetings of Section I.—Sanitary Science and Preventive Medicine. Section II.—Engineering and Architecture. Section III.—Physics, Chemistry, and Biology in Mason University College.

5 p.m.—Closing General Meeting of the Congress in Mason University College.

8.30 p.m.—Popular Lecture in The Birmingham and Midland Institute.

SATURDAY, OCTOBER 1ST.

Excursions.

Excursions and Visits to places of interest will be made during the Congress.

[*Particulars will be given in future Programmes.*]

AMONG THE SUBJECTS PROPOSED FOR DISCUSSION AT THE CONGRESS ARE:

Antiseptics in Food.

Prevention of Tuberculosis in relation to Meat and Milk Supply.

Central Cooking Stations.

Bacteriological and Clinical Diagnosis in relation to the notifiable Infectio
Diseases.

Prevention of Measles in reference to School Attendance.

The Soil in relation to Typhoid.

Vital Statistics.

Dwellings of the Working Classes.

Birmingham Water Scheme.

Water Supply for Rural Districts and the means of Protecting it fro
Contamination.

The Qualities of Sewage as affecting the Method of Disposal.

Recent Advances in Sewage Treatment: (a) Towns. (b) Country Houses.

The Natural Purification of Sewage.

The Flora of Sewage.

Purification of Trade Effluents and Utilisation of Factory Waste Products.

Ventilation of Sewers and Drains.

Construction and Ventilation of House Drainage.

The Drainage of Buildings possessing no open space.

The Geology of the Midlands in relation to Water Supply.

Female Occupations in relation to Health.

The Hygiene of Infancy.

The Waste of Infant Life.

Village Nursing of Infectious Disease.

Influence of Women in regard to Household Sanitation.

Woman's Share in Sanitary Administration.

Hygiene of Dress.

Teaching of Sanitation in Elementary Schools.

THE HEALTH EXHIBITION

WILL BE HELD IN

BINGLEY HALL,

BIRMINGHAM,

On TUESDAY, SEPTEMBER 27th, and will remain open till OCTOBER 22nd, 1898.

The Exhibition is held in connection with the Seventeenth Autumn Congress of The Sanitary Institute, and includes Sanitary Apparatus and Appliances, and Articles of Domestic Use and Economy.

The Principal Boroughs throughout the Kingdom have appointed Delegates to the Meeting, in addition to the Members and ordinary visitors, so that the Exhibits will be brought under the notice of Members of Corporations and Officials from all parts of the country.

The Building is a permanent Exhibition Building, and is well adapted for an attractive Exhibition.

Applications for Space must be made on the Official Form and under the proper Class. They must be sent to Mr. W. H. KNIGHT, the Curator of the Exhibition, at the Offices of the Institute, Margaret Street, London, W., not later than Saturday, September 3rd, 1898.

The Scale of Charge for Floor Space is 15s. per Foot frontage, with a depth of six feet. Corners and Special Places are charged at higher rates. Wall space, 1s. per square foot. No Floor Space will be allotted for less than three feet frontage, or Wall Space for less than five square feet. *All charges must be paid at the time of allotment.*

Silver and Bronze Medals will be awarded at the discretion of the Judges, and their decisions will in all cases be final. A complete classified List of all Awards from the commencement of the series of Exhibitions is published by the Institute.

Protection in accordance with the Patents, Designs, and Trade Marks Act, 1883, will be obtained from the Board of Trade for persons desirous of exhibiting New Inventions.

Forms of Application for Space and other particulars can be obtained of the Curator at the Offices of the Institute, 72, Margaret Street, W.

OBJECTS OF THE INSTITUTE, RULES FOR THE ADMISSION OF MEMBERS, &c.

The Objects of the Institute are: To promote the advancement of Sanitary Science in all or any of its branches, and to diffuse knowledge relating thereto.

Sessional Meetings of the Institute are held in London from time to time, for the reading of papers and for discussions upon subjects connected with Sanitary Science.

Journal.—At the Congress and Sessional Meetings many valuable papers and Lectures in connection with Sanitary Science are read and discussed, and are printed in the Journal of The Sanitary Institute supplied gratuitously to the Fellows, Members, and Associates. The Journal also contains a Report upon the Exhibition of Sanitary Apparatus and Appliances held in connection with the Congress; notes of Parliamentary Blue Books and Reports; notes on various books published, not merely in England, but throughout the world, and it forms a record of the most recent progress in Sanitary Science generally.

Courses of Lectures and Demonstrations for Sanitary Officers, specially adapted for Candidates preparing for the Institute's Examination for Inspectors of Nuisances, are held twice a year in London, and at intervals in the Provinces, preceding these Examinations: a nominal admission fee is charged for each course.

Other Lectures on Sanitary matters, such as Sanitation of Industries, Meteorology in relation to Hygiene, are arranged from time to time by the Council.

Examinations are held, and Certificates of Competency in Sanitary knowledge are granted. The Examinations for Inspectors of Nuisances are held in London and also in Provincial centres. Examinations are also held in London in Practical Sanitary Science.

A Congress for the consideration of subjects relating to Hygiene, and an Exhibition of Sanitary Apparatus and Appliances, are held by the Institute.

In connection with the Meeting, Conferences are held for Medical Officers of Health, for Borough Surveyors, for Inspectors of Nuisances, and for Ladies.

The Parkes Museum, which is maintained by the Institute, contains a great variety of the most approved forms of apparatus and appliances relating to health and domestic comfort.

Professors and Teachers of Hygiene are allowed the use of the Museum for Demonstrations to their Students on application to the Committee.

In order to preserve the Educational character of the Museum, it is essential that the Council should be continually adding new inventions to the collection, and as the space is limited, it is necessary for them to retain the power of changing the exhibits from time to time; this precludes any charge being made to exhibitors for space in the Museum.

The Museum is open daily from 10 a.m. to 6 p.m., and on Mondays to 8 p.m., and is free to the public except when Lectures or Meetings are being held.

There is a large Library of Sanitary Literature, which contains, in addition to standard works on Sanitary Science, a collection of Reports of Medical Officers of Health over the whole country; and a Reading Room supplied with the principal Sanitary periodicals, both home and foreign.

The Council will be glad to receive from Authors of works on Hygiene and the allied Sciences copies of their books to place in the Library.

The Library and Reading Room are open daily, from 10 a.m. to 6 p.m., for the use of Members, Associates, and Students.

Honorary Fellows.—Foreigners distinguished in connection with sanitary science can be elected by the Council. Honorary Fellows are not corporate members of the Institute.

Fellows are elected by the Council from the members of at least one year's standing, on one or other of the following grounds:—

1. That he is an eminent man of science. 2. That he is a person of distinction as a legislator or an administrator. 3. That he is a person who has done noteworthy sanitary work.

Fellows pay on Election a Fee of £5 5s.

Members are elected by ballot by the Council. The Admission Fee payable by a Member is £3 3s., and the Annual Subscription £2 2s.

Any person elected a Member who shall either be a Medical Officer of Health, or have from some Examining Body a Sanitary Science Certificate (the sufficiency of which Certificate shall be recognised by

the Council),* or be both a Surveyor having his appointment from some Parliamentary Sanitary Authority and a Member or Associate Member of the Institution of Civil Engineers, or hold the Certificate of the Sanitary Institute of Great Britain or of this Institute, of competency for the appointment of a Local Surveyor, shall pay the smaller Annual Subscription of £1 1s., and shall be exempt from the payment of any Entrance Fee.

Members desirous of becoming Life Members may do so on payment of £21, in lieu of the Annual Subscription.

Associates are elected by ballot by the Council. The Admission Fee payable by Associates is £2 2s., and the Annual Subscription £1 1s.

Associates who at the time of their election shall either have received the Certificate of the Sanitary Institute of Great Britain or of this Institute, of competency for the appointment of Inspector of Nuisances, or who have held the appointment of Inspector of Nuisances in any district at the date of the incorporation of the Institute, shall pay the smaller Annual Subscription of 10s. 6d., and shall be exempt from the payment of any Entrance Fee.

Associates are not Corporate Members of the Institute.

Associates desirous of becoming Life Associates may do so on payment of £10 10s. in lieu of the Annual Subscription.

Forms of application for admission to the Institute, and the Examinations; and all further information, can be obtained from the Secretary.

* The Certificates recognised by the Council, in addition to the Certificate for Local Surveyors granted by the Institution, are: Certificate in Practical Sanitary Science granted by the Sanitary Institute; Certificate in Sanitary Science granted by the Surveyors' Institution; Certificate of the Incorporated Association of Municipal and County Engineers.

Kenny & Co., Printers, 25, Camden Road, London, N.W.

Stanford University Libraries
3 6105 004 727 124

RA421
S3
v.19
1898

STANFORD UNIVERSITY LIBRARIES
CECIL H. GREEN LIBRARY
STANFORD, CALIFORNIA 94305-6004
(415) 723-1493

All books may be recalled after 7 days

DATE DUE

MAR 8 1994
MAR 22 1994
MAR 1994